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CONTENTS

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE NEED OF PRACTICAL COOPERATION OF EDUCATIONAL AND OF MEDICAL DEPARTMENTS IN MODERN UNIVERSITIES

THE object of this paper is, first, to show the present status of affiliation of schools or departments engaged respectively in the training of physicians and of teachers, and secondly, to present a plea for a more general and effective cooperation between medical and educational departments where the interchange is warranted by technical training and material resources in both departments. Herein we are concerned particularly with the training of teachers pursuing at least a four years' course in a good college or university department of education and also, on the medical side, with the supplementing of the training of prospective physicians who intend to participate in the work of the schools.

Our general topic suggests the whole field of modern sanitation as it concerns not only the teacher and the medical inspector, but also the engineer, economist, etc., a field into which more than one of our universities have entered. We shall consider only hygiene and related topics as mainly affecting the teacher, superintendent, principal and the medical inspector, school nurse and assistants.

The actual status of the affiliation between medical and pedagogical departments of universities in the United States is revealed in the results of inquiry instituted by the writer in March, 1912. A circular of inquiry, including stamped return envelope, sent through the Newcomb School of Education, was mailed to the deans re-

spectively of every medical department or college and of every educational department in the United States, according to the enumeration in the U. S. Educational Report. Homeopathic, eclectic, physio-medical colleges, etc., were omitted.

H. SOPHIE NEWCOMB MEMORIAL COLLEGE
THE TULANE UNIVERSITY OF LOUISIANA
NEW ORLEANS

March 7, 1912

Dear Sir:

I am attempting to obtain definite information concerning the present affiliation of the medical and the pedagogical departments of typical American universities. Will you kindly cooperate to this end by responding to the following questions and return this sheet in the enclosed envelope?

I. (*a*) What courses intended specifically for teachers or prospective teachers (elementary, high, normal school or college teachers and principals or superintendents) are being offered by your medical department? (*b*) Duration of courses? (*c*) Number enrolled this year? (*d*) Any certificate or diploma awarded for completion of same by teachers or prospective teachers?

II. (*a*) What courses in pedagogy are offered by your department of pedagogy or education for the benefit of physicians or medical students or nurses who are or intend to become inspectors of schools? (*b*) Duration of courses? (*c*) Number enrolled this year? (*d*) Any certificate or diploma awarded for completion of same by physicians, medical students or nurses?

III. Please write any other relevant information or practical suggestion regarding possible need for cooperation between medical and pedagogical departments.

Yours very truly,
DAVID SPENCE HILL

To the medical colleges 112 inquiries were sent out, and to date 69 responses have been received. To departments and schools of education 102 responses are at hand from 160 inquiries—many of them sent in both instances to very small institutions.

The responses may be generalized into the following groups:

1. Those from medical colleges which have no university connections and which report no work whatever for the benefit of prospective teachers.

2. Responses from educational departments within colleges and universities which have no medical departments and which offer no work especially intended for medical inspectors, school nurses or school sanitarians.

3. No active affiliation reported from medical and from educational departments of certain universities.

4. Active or pending affiliations and cooperative courses in medical and educational departments, where prospective teachers with adequate academic and professional training and prospective physicians hold common interests.

5. Individual opinions and suggestions concerning the need of such affiliated courses.

Most of the responses are of types 1, 2 and 3. It is evident that so far as formal action by our institutions of learning is a criterion, the training of the majority of physicians and teachers in colleges is not parallel or merged and generally there is no point of practical contact. In view of the Carnegie report on medical education, and in view of the struggling existence of the courses of education, especially in normal schools, and to a less degree in college departments of pedagogy, this status of affiliation in some respects is satisfactory, although the correlated facts are deplorable. Scarcely a half dozen universities in the United States report a reasonably effective scheme for cooperation of medical and of educational departments. In view of the needs about to be enumerated and of a growing conviction that teachers need more scientific knowledge of hygiene in its broader sense, more knowledge both of mental processes and of the physiology of the child, as well as of the subject to be

taught, and that physicians who are medical inspectors are often lacking in adaptability, understanding and are actually incompetent without a sound basis of educational science—this failure of the prospective teacher and the prospective doctor to get together is unfortunate for both and for the child. Furthermore, there is a growing suspicion that one of the factors in the low state of medical education is the poor teaching done within the walls of medical colleges and the poorer grasp of the complex problems of the education of to-day. This is a day, in America and Europe, for the professional training of teachers; but who has heard of systematic provision for training teachers of medical students?

Nearly all of the small number of responses of groups 4 and 5 may be reproduced here verbatim, with a few of other types. As these responses are generally from representative institutions they constitute an interesting symposium. A few responses which came unsigned are omitted. A later mail may bring in also a few more. Here are the responses from the following institutions in slightly abbreviated form and with the name of the senders prefixed: Johns Hopkins, Pennsylvania, Chicago, Teachers College of Columbia University, University of Pittsburgh, University of Cincinnati, St. Louis University School of Medicine, the University of Minnesota, the University of Wisconsin, the State University of Iowa, the University of Illinois, the University of Nebraska, the University of Michigan, the George Washington University, Vanderbilt University, University of Virginia, the Tulane University of Louisiana.

Johns Hopkins University, Baltimore, Md. Dean J. W. Williams, Medical Department.

Your circular concerning the affiliation of medical and pedagogical departments of American universities is at hand. Our medical school makes no effort to give this sort of instruction. The philosophical department of the university, however, offers a number of courses to teachers and in its summer school affords opportunity for instruction. Furthermore, a number of "health courses" are offered to the general public by the medical and chirurgical faculty of Maryland (The State Medical Association).

Professor E. F. Buchner, Department of Education and Philosophy.

I regret to state that we have nothing to report from the Johns Hopkins University on the cooperation between the medical department and the various lines of work which are being offered to teachers. For one reason at least the need of this cooperation in Baltimore is not so essential, in view of the fact that the medical and chirurgical faculty in addition to the several medical schools and medical associations, has been doing a great deal of work along the line of the medical aspects of public education.

University of Pennsylvania, Philadelphia, Pa. Director A. C. Abbott, of the Laboratory of Hygiene.

I have read the several questions contained in your letter, and do not feel in a position to give categorical answers to any or all of them, although one of the courses given in this laboratory might be regarded as remotely related to the topic which you are considering. The course to which I allude is that leading to the degree in public hygiene, a subject that has been sadly neglected in this country, and one for which trained teachers are more or less in demand. I can not say, however, that the course is designed especially for the training of teachers, but rather with the idea of giving to the candidate a broad grasp of

the fundamentals of the subject in such a manner that they may be used for either teaching or practical work in the field of public hygiene. There is one portion of the course, I think, which might properly be regarded as suitable to teachers in any department, notably, that having to do with the various defects observable in school children. It is the portion of the course designated as medical inspection of school children.

Harvard University, Cambridge, Mass. Dean Henry Christian, Dean of Medical College; Professor Henry W. Holmes, Division of Education.

No affiliation of the Medical and Pedagogical Departments of this university.

The University of Chicago, Chicago, Ill. Dean John M. Dodson, The Medical Courses.

There are no courses specially designed for teachers or prospective teachers in the biological sciences department where the medical courses are taught. Many teachers, however, take some of these courses each year, how many it is not possible to say accurately.

I am mailing to your address an announcement of Rush Medical College, in which you will find all the courses described. I would say that a few teachers expecting to go into physical-culture work take the courses in human anatomy. Others do work in physiology, pathology and bacteriology. No certificate or diploma is given to students completing these courses. They may be taken by students registered in various departments of the University of Chicago and allowed to count for credit towards the bachelor's degree.

We hope that the several departments in the university will offer courses relating to hygiene and sanitation and that we may be able to offer a definite curriculum designed for men and women who desire to go into the public health service. At present no such courses are offered.

Chicago University, Chicago, Ill. Director Charles H. Judd, the School of Education.

There is no active affiliation between the college of education and the medical school. One of the members of our faculty is finishing his work in a medical course in Munich, Germany, during the present year, and expects to take up work for retarded children with the opening of school for next year. This work will be done, however, in the college of education and not in the medical school. I think some such affiliation as you have in mind would be of very great advantage, but we do not have it as a matter of fact at the present time.

Teachers College, Columbia University, N. Y. Dean James E. Russell.

We have no connection with the school of medicine. However, the professor of physiological chemistry directs our work in that line. We have large departments of our own in hygiene, nursing and health, etc. Please see announcement sent herewith.

The University of Pittsburgh, Pittsburgh, Pa. Professor W. G. Chambers, the School of Education.

None in medical department. Certain teachers in the city schools have taken courses in physiology, bacteriology and the like with the regular medical classes. Plans are now being developed looking to a cooperation of courses between the school of medicine, the school of education and the college. In the school of education our courses, psychology and principles of education, school hygiene, psychology and pedagogy and defective children and the like, are open to medical students, but have not been attended by any to date. We are planning to offer a course for the training of school nurses which will in-

clude work in both the medical school and the school of education. We are now about to start a group of clinics, involving a psychological clinic, a social clinic, a medical clinic and a dental clinic, which will bring together the four corresponding schools of the university in a work which affects the training of teachers. A certificate will be granted for the work mentioned.

University of Cincinnati, Cincinnati, Ohio. Dean W. P. Burris, College for Teachers.

We have no such affiliation between the medical and pedagogical departments as you imply. I have often thought about the question of relating these departments, but could not decide how it could be brought about. I will be much pleased to learn the result of your inquiry. I have no doubt that teachers and instructors would profit greatly by some correlation of medical and pedagogical courses.

St. Louis University School of Medicine, St. Louis, Mo. Dean E. P. Lyon.

Your circular letter regarding the teaching of pedagogics in St. Louis University came to the medical school. As we have no such work in this department, I am referring the letter to the college department in which young men are trained for teaching in the Jesuit order. I have no doubt you will hear from the authorities in regard to this work. In writing you, I am reminded of a thought which has frequently recurred to me, namely, there is no normal or teachers' college for medical teachers. I believe that medical teaching has need of application of pedagogical principles. It is possible that people who are specifically engaged in the work of teachers' colleges might be of some assistance to medical education by studying these questions.

The University of Minnesota, Minneapolis, Minn. Dean F. F. Wesbrook, College of Medicine and Surgery.

We shall have to answer most of your questions in the negative, but we desire you to know that we have thoroughly considered and are planning for the various phases of public health instruction. In answer to your question number 1, we have to say that certain of the teachers on the staff of this college are giving instruction to students in the college of education—notably Dr. R. O. Beard, on personal hygiene. I myself give instruction in the matter of infectious diseases and their prevention and have every year for some years tried to give practical talks along these lines. We are, however, giving no courses in the college of medicine and surgery as such, which are intended for students in the college of education. All of the students in the college of education attend the instruction by Dr. Beard and myself. No definite courses in pedagogy are offered to the students in our college, but you will see in the catalogue of the current year, pages 58 *et seq.* We provide a coordinated series of lectures by those who are well able to give the work. For instance, Dr. Keene, who is in charge of the physical training and medical school-inspection of the Minneapolis public schools, instructs our students in medical school inspection, physical training and school hygiene. Mr. Rankin, professor of education in our university, and Mr. C. G. Schulz, state superintendent of public instruction, and *ex-officio* a member of our board of regents, both give instruction to our medical students in their senior year in this course of which I have spoken; one from the view-point of the teacher and the other from the point of view of the child. In this way we get a symposium by those whose daily work is giving them practical experience in the lines which we ask them

to teach our students. We have similar symposia on the tuberculosis question. I enclose herewith copy of that which was given this year. The same sort of thing is done in the matter of milk supply, its sanitary aspects, etc. At the present time I have been instructed by the board of regents to report upon a public-health school here in our university and expect to report a definite mechanism within the next short time.

Dean George F. James, College of Education.

We have not yet worked out a plan of cooperation between our medical college and the college of education; although we are interchanging some lectures at the present time. Some of the medical faculty have been assisting in our work in school hygiene and some of our men have been speaking occasionally to the medical students on conditions which seemed helpful for them to know in regard to the schools.

The University of Wisconsin, Madison, Wis. Dean M. V. O'Shea, Department of Education.

In this department none whatever, although I earnestly hope such courses may be offered within the next two or three years.

Dean Charles R. Bardeen, Department of Pharmacology and Toxicology.

In the department of physiology a special course is offered for prospective teachers of that subject in high schools, normal schools or colleges. In the department of anatomy a special course is offered for students preparing for teaching physical training. In the department of bacteriology and hygiene courses are offered in these subjects open to teachers. In the other departments of the medical school no specific teachers' courses are offered, although occasionally special training is given individuals who may desire to teach. So far as I know, no courses are offered in the department of pedagogy for the benefit of physicians or medical students, or nurses who are or intend to become inspectors of schools. Many of our medical students do some teaching after completing the two years of the medical work which we offer before going elsewhere to complete their medical course. All such prospective teachers, if they intend teaching in Wisconsin, have to take some courses in the departments of education on the principles of pedagogy. In general I should say that public school teachers should have more acquaintance with preventive medicine than most of them have at present, and that we should probably look forward here to developing special training of this character, although little is done at present. I shall be glad to hear the results of your inquiries in order that we may have data from which to derive methods along these lines. I feel that we have at the University of Wisconsin, at the present time, little along these lines which would be of value to you.

The State University of Iowa, Iowa City, Iowa. Director Frederick C. Bolton, the School of Education.

I regret very much that we have no satisfactory data to report concerning the relation between the college of medicine and the department of education. There is an entirely cordial feeling existing between the faculty in the medical college and the department of education. Several of the faculty members are much interested in our work in education, and we are certainly interested in many phases of their work. There is a movement on foot to establish a psychopathic hospital, the activities of which will include some phase of educational work. It will include the training of defective children. Some of the members of the faculty of the college

of medicine are directly interested in the pedagogical side of the work. It may be that at a later time I can write you additional information concerning our work. I believe there ought to be a definite relation and there ought to be a pedagogical training for those who are preparing to be school physicians, on the one hand, and, on the other hand, the regular teachers ought to get some knowledge of psychopathic conditions.

The University of Illinois, Urbana, Ill. Dean William E. Quine, College of Medicine.

Reports "none" for the questions.

The University of Nebraska, Lincoln, Nebr. Acting Dean Robert H. Wolcott, College of Medicine.

Cooperation between the pedagogical department of the university and the medical school is a thing very much to be desired. We have discussed the matter here somewhat and a certain amount of cooperation has been effected by the formation of a section on public health in the State Teachers' Association, the activity of which is largely the activity of the college of medicine, and also by the giving of occasional lectures in the course of pedagogy by those connected with the faculty of the college of medicine. A condition which has interfered somewhat with close cooperation is the fact that our medical school is divided, the two clinical years, including the courses in sanitation and hygiene, being given in Omaha, and the first two years consisting entirely of laboratory work, being given here. Not only are the members of the faculty here in Lincoln engaged in teaching subjects not particularly important to the students in pedagogy, but the work already required of them is so heavy that I do not feel it fair to impose an additional course upon them.

The University of Michigan, Ann Arbor, Mich. Dean V. C. Vaughan, Medical Department.

A course in general hygiene given in the medical department of this university is open to all students in the literary department, and is especially recommended for those who intend to teach. Every student entering the university should have a thorough physical examination, and it would be better if this examination could be repeated once a semester. In all departments of the University of Michigan except the law department, all entering students are compelled to take a thorough physical examination. Any defects are referred to the physicians in the medical department. Students in the medical department are required to pass a physical examination once a semester.

The George Washington University, Washington, D. C. Dean Bowden, Department of Medicine.

We have no courses in the department of medicine of this university intended especially for teachers or prospective teachers. There is a teachers' college which is a department of the university in which instruction is especially given to teachers and some of these students take courses in physiology and histology in our laboratories. Up to the present time the above method, namely, of having students in the teachers' college taking such courses as they desire in our medical school appears to have covered all requirements.

Vanderbilt University, Nashville, Tenn. Dean Dudley, Medical Department.

No educational department.

University of Virginia, Charlottesville, Va. Dean Whitehead, the Medical Department.

No such courses offered by this department.

University of Texas, Austin, Texas. Dean W. S. Sutton, Department of Education.

None, but in the course in school management and also in a course of school administration and supervision some attention is given to matters relating to school hygiene. In the further expansion of the department of education in the University of Texas it is hoped that provision will be made for the establishment and maintenance of a school of physical education, in which school a number of courses will be conducted.

Leland Stanford Junior University. Executive Head R. L. Miller, Department of Medicine, San Francisco, Cal.

The courses for medical students in physiology, anatomy, chemistry, bacteriology and embryology are all given immediately at the university. Many students from the educational department take them and all can do so if they have proper preliminary work. Certificates or diplomas are awarded only as parts of the work leading to the university degrees. In the educational department about 30 students take course 28, physical aspect of the child (Professor Terman); and about 50 take course 29, school hygiene (Professor Terman). A few of these will later complete a medical course and take up school hygiene as a profession.

The Tulane University of Louisiana, New Orleans, La. Dean Dyer, Medical Department.

None at present. Projected courses for teachers and prospective teachers in department of hygiene and preventive medicine.

Professor Hill, Psychology and Education.

Arrangements are nearly completed whereby candidates for the B.A. degree in education, prospective teachers, may elect hygiene for their major subject. The work in hygiene will be partly under the direction of Professor Creighton Wellman, of the school of tropical medicine and hygiene. The administrators also have made an appropriation for a laboratory of psychology for Newcomb College, an adjunct of which will be a psychological clinic for the study of the problems of childhood. In this work members of the medical staff, it is intended, will cooperate with psychologist, teacher and sociologist. The work of the laboratory begins in 1912.

The reasons for the advocacy of a more effective cooperation of physicians and teachers within such departments may now appear from consideration of several aspects of the subject. The basis of modern teaching is experimental and genetic psychology. The need of contact between physician and teacher in the study of scientific psychology is recognized in the problem of psychopathic conditions of childhood. Dr. J. E. Wallace Wallin in a recent number of the *Journal of Educational Psychology* has summarized the data concerning the growth of clinics for the study of psychopathic conditions in school children. In these educational laboratories psychologists, physicians and educators unite in studying the problems of the exceptional child whose unprovided for presence in our schools is to-day potent in affecting the lives of the majority of the pupils and the teacher. Notable among such institutions are Professor Goddard's laboratory at Vineland, N. J., Professor Witmer's clinic at the University of Pennsylvania, Dr. Healy's in Chicago and the Psychological Clinic conducted by the Gatzert Foundation for Child Welfare of the University of Washington, as well as others existing or projected. The recent discussion participated in by Myer, Watson and others in Washington during the meeting of the American Association for the Advancement of Science concerning the relation of the psychology of the academic department to the work of the medi-

cal schools, evinces this issue before the medical college, an issue which concerns both pedagogy and medicine. The unity of mutual interests in the field of pedagogy is pressing both upon the educator and upon the physician.

There is the increasing recognition by our citizenship of the importance of the physical aspects of life in the process of education. This modern recognition of the physical correlate of psychic life is evinced by many signs. There are the concerted efforts of legislators, reformers, physicians and educators in behalf of better sanitation of the schools. There are movements for improved medical inspection of children, teachers and premises, for accumulative records concerning physical and mental development and for study of, and providing for, the detection and care of, feeble-minded children. Organizations such as medical associations, educational associations and civic societies have united in their efforts in behalf of the health of the child, since the larger meaning of health in its relation to formal education has become better understood. It is significant, for example, that we read of the cooperative efforts of physicians and of educational specialists in the report of the Public Health Educational Committee of the American Medical Association as published in the Proceedings of the National Education Association. Equally significant as a symptom is the report of the sub-committee of the Committee of One Hundred of American Medical Association which recommends for medical education, in behalf of public sanitation, practical means for actual cooperation of physicians, lawyers, engineers, statisticians, professional sanitarians and educators. With regard to the last the recommendations embody the following: "The medical point of view should be given to the educationalists and the medical man should add to his medical knowledge some practical working experience in the daily problems which confront the educator."

The increasing literature both from students of education and also of medicine concerning the health of the school child, and the discussions by both teachers and by physicians at international and at local congresses of school hygiene also are evidences of the world-wide significance of the theme. Researches upon specific activities of school life as affecting the human organism, in both its physical and psychical aspects, are further evidence of the advent of the method of science into the realm of pedagogy. Contrast, for example, the obsolescent pedagogy of opinion *vs.* fact, of metaphysics *vs.* statistical investigation, with such recent quantitative investigations as those of Meumann, Winch, Thorndike, Dearborn and Ayres. If in the past educators have been addicted to metaphysics and the didactic habit, equally physicians have been alleged to lack any "quantitative sense." The present trend in literature toward exact observation is bringing both professions closer.

The remarkable growth of medical inspection of school children is due to the wide recognition of the necessity of cooperation between teacher and physician. At the basis of this cooperation is the modern belief that health, wholeness of body and mind, is the prerequisite of maximum good for the individual and for society in education. Most of us have reacted far from the ideal of Stylites who considered that superlative moral excellence was best gained through indifference and even torture of the body:

> . . . I die here
> To-day, and whole years long, a life of death,
> Bear witness, if I could have found a way—
> And heedfully I sifted all my thought—
> More slowly painful to subdue this home,
> Of sin, my flesh, which I despise and hate
> I had not stinted practise, O my God!

The practical interdependence of body and mind is evident enough whether we chose evidence from: the facts (1) of common experience, (2) of pathology or from (3) the psychological laboratory. But in the past many, and in the present not a few, educational leaders seem to neglect this significant fact. They have busied themselves with the subtleties of metaphysical speculation to explain the ultimate nature of this mind-body relation, or failed altogether to profit by the opportunity for, and the results of, research, regardless of the ultimate nature of reality. Whether as physician one is interested predominately with the physical aspect of the human organism, or whether as teacher predominately with the mental aspect, neither skilled teacher nor physician today can ignore the physical or the mental to the neglect of the other. So far as both teacher and physician are men and humanitarians, each is willing to supplement the other where cooperation facilitates the progress of the race. Notwithstanding the endless differences of opinion about the details of educational theory, and the rumor that in their respective councils both doctors and pedagogues disagree, nevertheless one sure point of agreement in education is the necessity for adequate provisions for health, both in school and in industry. The health movement in education is one of the most hopeful signs of the times; it is based upon the logical results of experience and of systematic observation and has more far-reaching results than the results merely within the school room. It is a beneficent influence that is modifying architecture, sewerage systems, food supply, methods of control and prevention of disease, and is modifying our art, our ethics and our religion, man's three great remedies for the evils of human knowledge. Opposed we find the horde of the "curists," whether simply ignorant or neurotic or criminal.

The cooperation of trained workers in the medico-pedagogical field has gained headway against difficulties. Inertia of public opinion, administrative difficulties and organized opposition from combinations of quacks, enthusiasts and patent-medicine interests opposed to state control of health measures, are difficulties encountered in many states. One of the most vicious combinations of heterogeneous frauds is the American Association for Medical Freedom, which through paid representatives has been perniciously active in efforts with legislative assemblies, as, for example, recently in Tennessee.

Difficulties of another kind are: (1) incompetent and unintelligent physicians in the public-school services; (2) incompetent and unintelligent teachers; (3) the resulting failure to obtain the desired cooperation of a scientific pedagogy and of scientific medicine in behalf of the school child. The incompetency of the school physician, if we take for granted his moral worth, may be with regard to training either in medicine or in pedagogy. The Flexner and other reports are proofs regarding the low condition of medical education in America. It is difficult throughout the country to secure highly skilled physicians to do the unremunerative work of school inspection. This notorious difficulty increases the want of respect that the teacher and citizen have for some medical inspectors, school physicians and sanitarians. The deficiency of the average physician in pedagogy, or in the science and art of education, is not unexpected, but his frequent lack of appreciation of the inherent complexity of the problems of the school or of knowledge of any one large part of modern pedagogy, be it educational psychology, experimental pedagogy, the

history of education, the principles of education, educational statistics and quantitative treatment of data, lessens both his working efficiency and the respect and influence which his work should bring. If we couple with this two-fold incompetency an air of wisdom and the trick of silence in the medical inspector, it then results that he gains the contempt of the men and women in education who may have enjoyed thorough academic and professional training for their life work. Personalities being equal, the man who has his doctor of philosophy in education from a modern university following the requisite bachelor of arts in college, is relatively better trained for the work of the school than is the average physician who possesses merely the degree of doctor of medicine, for the practise of medicine. Very few young physicians of to-day, relatively to the number being graduated, have collegiate training, or prolonged experience within schoolrooms, and, if literary degrees be any criterion of school experience they have less of this academic training than students in law or in theological schools. Note the recent statistics of the United States.[1]

Schools	Students	Number having Literary Degrees	Per Cent.
184 theological,	11,012	3,064	28
114 law,	19,567	4,107	21
135 medical,	21,394	1,883	9

In the majority of physicians from whom we must choose our medical inspectors and school physicians, we observe neither academic training in general culture courses nor pedagogical training, such as is being demanded more and more of every teacher for the elementary, high and normal schools and colleges. Great is the need of the presence of the physician-inspector in the public school, but great also is his need of academic knowledge and of training in the essentials of pedagogy. To the average citizen the physician comes in moments of dependence and with a traditional prestige and with at least a modicum of technical knowledge which he may wield to the disadvantage of the layman. The partially trained physician in the presence of the problems of the school, naturally may suffer from a mental myopia from which he is unconscious and it is difficult to convince him of his ignorance where it exists. The pedantry of the confirmed pedagogue may have its counterpart in the professional assurance of the routine practitioner and the common, invalid assumption that "a man skilled in one thing is good at everything he undertakes."

If we are to bring about needed cooperation in the medical and teaching professions in life we must begin with fundamentals. We should labor with the professional training of those who are to work, either as teachers or physicians, in our schools. Already the medical profession has achieved greatness in the education of the people in the prevention of disease. Through literature, lectures, committee work, legislation and public-spirited activities, the beneficial effects of the noble work of prevention of disease is felt in every path of life. Magnificent are the results of the modern physician and sanitarian in the battle, *e. g.*, against yellow fever and the hook worm, or against tuberculosis. This country of modern cities with stupendous populations could not exist happily but for the public hygiene engineered by noble spirits in the medical profession.

In the schools we have millions of our population, the majority of our people during the years of plasticity and during years when they are amenable to a high degree of control. In the schools is the superlative opportunity for teacher and

[1] U. S. Ed. Report, 1910, Vol. II., p. 1017.

physician cooperating to benefit the race. If it be agreed that both educator and physician should understand and practise school hygiene as only one of the increasingly numerous departments of a modern pedagogy, how can this knowledge and practise be affected without specific, organized training in hygiene, both for prospective teachers and prospective medical men, for the schools? Educational hygiene is but one division of the field of hygiene and demography. Consideration of its bare outlines as offered for discussion at the next international congress on hygiene and demography should yield the conviction that if this field is to be mastered, the medical and educational departments of modern universities are laggards in progress where effective cooperation is not accomplished.

In conclusion we may venture to enumerate four ways for effecting an immediate and practical cooperation between the educational and pedagogical departments of well-equipped universities.

1. With reference to the need of the schools, provisions should be made for senior medical students, and especially for graduates in the educational department, by instruction and training in the essentials of pedagogy to be chosen from courses and with books such as: "History of Education" (Monroe); "Principles of Education" (Bolton); "Educational Psychology" (Thorndike, Starch, Pyle, Bagley); "Educational Statistics" (Ayres, Thorndike); "Experimental Pedagogy" (Whipple, Meumann, Claparede). These presuppose a basal knowledge of psychology—some of which must be got in the laboratory. In this basal study of psychology of common interest to teacher and physician, the majority of medical students obtain no systematic training whatever, a fact not surprising since, according to Flexner's report, half or more of the medical schools require less than a good high school course for admission; half have meager laboratory facilities even for physiology, pharmacology or bacteriology; teaching of anatomy and pathology is often didactic; clinical facilities are usually inadequate and many colleges are "reeking with commercialism." In medical departments where such deplorable conditions do not exist it seems most reasonable to supply instruction in general or introductory psychology, both to medical and pedagogical students, by utilization of the psychological laboratory of the academic department.

Medical students who undertake the work in pedagogy as prospective school inspectors or school physicians should undertake the extra training either in a graduate year or elect a minimum during the senior year of the medical course. This election would necessitate the elimination of certain fractions of pharmacology, obstetrics or studies not of essential use to the professional school physician. This questionable elimination, however, would be avoided by placing all of the pedagogical work, save the elements of psychology and of hygiene, in the post-graduate year or years. Since the writing of this paper, some interesting detailed suggestions regarding such adjustments of curricula have been offered under the title: "Professional Training for Child Hygiene" by Professor Lewis M. Terman, Ph.D. (*Popular Science Monthly*, March, 1912).

2. Appropriate courses in education should be offered prospective school nurses.

3. In recognition of the fact that throughout the country the majority of high-school teachers lack professional training in both the subject they teach and also in pedagogy, there should be a more general effort in our universities to supply the present need for professionally trained

teachers for high schools, whenever the bachelor's course is regarded as the maximum obtainable preparation. The college student who desires to become a specialist in school hygiene or a public sanitarian may omit the regular medical course and proceed from the bachelor's degree to the doctor of philosophy in hygiene or to the new degree of doctor of public health. In order to open this field to college men and women, candidates for the bachelor of arts in education should be permitted to follow hygiene as a major subject, extending through at least three years and properly correlated with other sciences, cultural and professional courses. In the courses, hygiene, preventive medicine, physiology and psychiatry, the medical department may be utilized. The following typical plan for grouping of studies for prospective teachers in college makes possible the choice of such a major subject and at the same time affords in the four years following the high school: (1) a basis of general culture in the languages, mathematics, sciences and history; (2) the essentials of pedagogy; (3) opportunity for increasing specialization under the direction of competent advisers.

Freshman	Sophomore	Junior	Senior
Eng. 3 hrs.	Eng. 3 hrs.	Gen. & Ed. Phy. 5 hrs.	Hist. & Prin. of Education 5 hrs.
Lang. 3 hrs.	Lang. 3 hrs.	Educational Hygiene 3 hrs.	El. or Secondary Education 3 hrs.
Math. or Hist. 3 hrs.	Math. or Hist. 3 hrs.		
Phys. or Chem. 5 hrs.	Biology (Physiology) 5 hrs.		
Elective 3 hrs.	Elective 3 hrs.	Elective 9 hrs.	Elective 9 hrs.
Total 17 hrs. per week.	17 hrs.	17 hrs.	17 hrs.

The electives (major and related subjects) courses should be chosen under careful guidance and with proper restrictions.

4. In the study of the school problems of elimination, retardation, repeating and of the exceptional child, the department of education should lead. The educational laboratory, and psychological clinic, an adjunct to the laboratory of psychology, is the point for concentration of effort upon these problems, by cooperation of psychologist, physician, sociologist and teacher. The demonstrated value of the modern psychological clinic must be rescued and preserved from the errors and excesses of incapable men and women, whether in medicine or in education.

DAVID SPENCE HILL

TULANE UNIVERSITY

THE EDUCATIONAL WORK OF A GREAT MUSEUM[1]

THE educational work of a museum should be governed entirely by the purposes for which the museum is established. The very greatest museums may give pleasure to the public, may educate the more intelligent groups of people, among which are college graduates, may educate such classes as teachers and children, and should not neglect the education of the masses. One of the most important services to education which a great museum can accomplish is to carry on surveys, explorations and original investigation, and it is only from such work that any facts are learned which may in turn be given out to mankind by means of exhibits, popular guide-books, scientific reports, lectures and contributions to encyclopedias, text-books, popular magazines and newspaper accounts. Great care should be taken that research work is never neglected in the stampede for "popularization." Such great museums may also have departments for special

[1] An abstract of an illustrated lecture delivered, in anticipation of the opening of the Victoria Memorial Museum, the national museum of Canada, at the inauguration in Ottawa of free lectures to the people under school board control, November 10, 1911.

classes of the people, as for instance blind people and kindergarten children.

Special museums must serve the specialty for which they are founded, and small museums also have to confine their work to a narrower scope of educational endeavor. Provincial museums seldom have sufficient funds to make world-wide investigations or teach all subjects, and it is perhaps best for such a museum to devote itself solely to its own province or certain subjects. The same is also true of a county, and in some cases a city, museum. The university museum should serve the purposes of the university, its students and professors, that is, supply illustrative material for classes, provide for the research necessary to keep professors up to date, and allow advanced students actual research experience. In common honesty its funds should not be used primarily for the general public or for subjects outside the line of the university's work. An art museum must confine itself to esthetics or other branches of art endeavor. A commercial museum of course should keep its attention on work of a commercial nature. It is evident that there are many methods of museum administration, each of them good in its own place and each of them bad or even dishonest when out of place.

A museum building should be constructed so that additions may be made to it without ruining its architecture or causing unnecessary expense for remodeling or making connections. Such a building should be built with a view to its purpose so that the laboratories, offices, exhibition halls and the like may be properly lighted and each suitable for its special kind of work. In the past museums have usually been built to please an architect and the result is that most museum buildings are abominably adapted to the use of the museum and its staff. The day must soon come when museum buildings will be constructed with a view to the purpose for which they are to be used and then the result of museum work will be even more worth while than at present.

No matter what the scientific investigator and the teacher may say, one of the justifiable purposes of a museum is to give recreation and happiness to great masses of the people and by far the greater number of visitors to the large museums drop in casually for just these purposes. Very few of them come to be educated or to carry on research, but from the casual visits many people carry away a desire to investigate and still more to receive educational benefits.

The educational section of a museum may be likened to extra illustrated text-books. For instance in text-books on birds, we may have pictures of birds, even colored pictures, but in a museum we have the actual birds, their skeletons, their organs, their nests and their eggs. Thus a large collection of birds in a good educational museum is like a great text-book on birds illustrated by these things, while the labels take the place of the printed matter in the text-book. Educational popularization should never be carried to the extreme of exaggeration and untruthfulness affected by certain schools of museum employees.

A museum may also serve as a great warehouse where are kept such valuable things as individuals should not horde in their homes. For instance an object from which something may be learned, and which is the only object of its kind in the world, should not be kept in a home where it may be destroyed by fire, but in a fireproof museum; nor ought it to be where its owner and his friends are the only ones able to see it, but it should be available for all who may desire benefit from it, whether they be citizens of the province or nation owning the museum, or visitors from the most distant lands. No museum should be a collection of merely curious things.

Sometimes animals, plants and the like are exhibited surrounded by representations of their natural home and in front of a painting representing the country in which they occur. Such exhibits depend for their excellence on the skill of the scientist who plans them, the collector who secures the material and artists and mechanics of various kinds. Each of

these does a particular share of the work which he is perhaps the only man able to do. The artist may be brought thousands of miles because of his ability to paint just the right kind of background. The museum expert is skillful in writing labels which may be understood not only by the scientist, who often knows all the facts without any label, but also by the people who do not know the facts and consequently need information. Such a man should write the label.

In a great research museum there are always thousands of specimens in the storerooms and laboratories kept for study and research; that is, they are used for the increase of human knowledge. To expose them to the light and dust of exhibition might destroy them while duplicate specimens, pictures, casts and models may serve equally well or even better for educating the public.

All great museums have brains, in other words they have a staff of experts who perhaps are not seen in the exhibition halls, but who find out the new knowledge which the people are always anxious to have, who plan the work, write the labels and guide-books, give the lectures, direct the field explorations and so keep the museum from ever being dead and dusty. One of the great museum men of the world once said that a finished museum was a dead museum, and this well expresses the idea that there is no such thing as a finished museum, for scientists are always making new discoveries which lead them to add new exhibits and rearrange old ones. There is always a great deal of work going on in the workshops, of which the visitors to the exhibition halls have little idea. This work can not be done by untrained men, but must be accomplished by artisans, mechanics and artists who have had very special training each in his own particular line. Sometimes in a country of millions of inhabitants there is no man trained in a certain special kind of work so that a museum often has to send across the sea or to some equally far-away place for a skilled mechanic. Even Japanese, Eskimos and Indians are employed in one of our largest museums. Many days' and sometimes months' work must be done—not by one man but by seven or eight men, each doing his own kind of work in the most expert way—to produce an exhibit from which the public may learn in a few moments what has taken all this time to produce. Then too one must not forget that to get some material by means of which new knowledge is found out, and by means of which this knowledge is diffused to all the world, hardy men must penetrate into the uttermost wilds of the earth, endure the bitter cold of the Arctic and the dangers of the tropical forest.

Some museums have many friends, for instance for years the Barnum and Bailey circus had all of its rare animals which died on the road embalmed or otherwise preserved and sent to one of the museums in New York City. Then, too, wealthy men vie with each other in giving funds for expeditions, research, scientific books, exhibits, teaching labels and guide-books, and for lecture courses in connection with these museums. Sometimes they endow a branch of museum work or an entire museum. Some men have each given more than a million dollars for such purposes and this is one of the indications of the value of a museum, for men capable of amassing millions do not endow institutions which they consider valueless.

Sometimes models teach quite as much as actual specimens. A model of a mosquito made many times larger than the insect itself shows us how to cope with malarial fever and yellow fever. We could not see the means by which the mosquito transmitted these diseases by looking at the mosquito herself, but the scientist in his laboratory with his microscope may find out all these things, make accurate plans and drawings of the various parts of the insect, and leave it to skilled mechanics to spend many months in reproducing them accurately on a large scale. Such work is not an extravagance when we consider that if the doctors and the people learn to avoid yellow fever and malaria the life insurance companies do not have to pay so much life in-

surance and the amount paid for one death is easily sufficient for the construction of such a model.

Pictures are very useful in connection with museum exhibits. Sometimes photographs are used, again sketches or paintings or transparencies, and frequently lantern slides are employed. These pictures may show the sort of country from which the objects come, or they may be reconstructions based on careful study. For instance, bones of extinct animals are frequently found. No one knows what these animals looked like in life, but the scientist can study the bones and compare them with the bones of animals which he is able to observe. He can have his artist paint these living animals and can explain to him in what respect the bones of the extinct animal differ. By a study of the bones of the feet he may learn and explain to the artist whether the animal walked in a swamp or on rocky ground. By a study of the animal's teeth he may tell what kind of food it ate. Then the artist can make his picture very much more intelligently than otherwise would be the case and this picture conveys to the people some idea of what the animal formerly looked like. Sometimes the artist makes a sculpture of the animal instead of a painting or to accompany the painting so that a complete exhibit might show a skeleton with a painting, a model, a label, a map, and perhaps even another animal such as lives to-day and is akin to the extinct animal.

A map may show the part of the world from which a specimen comes, other maps may show the details of its home country, and maps may be used to show its distribution over the earth and the relation of this region to some other area, as for instance one where certain plants grow. Maps may be mere outlines or shaded, or they may be relief models made to resemble a surface of the country.

Specimens may be arranged in series, and in this way teach much more than they would singly. One may arrange together specimens which illustrate the idea of evolution or which show all the different musical instruments of the world. One may show together all the things found in a certain province or all the animals, plants, minerals and so forth, of a certain region, as for instance a desert, and contrast them with things from a forest.

Different classes of people use museums. Carpenters and cabinet makers often study the collections of woods, miners the collections of minerals, teachers of art and architecture the collections of primitive art and the objects and pictures showing the types of buildings of other times and other peoples.

Some collections are of great value, as for instance the display of gems exhibited by Tiffany and Company at the Paris Exposition. Such a collection is sometimes protected by iron gratings on the windows, and armed guards night and day. Then too there may be electrical connection with the police department so that an alarm may be given either by the guard or when a case is broken open.

Exhibits showing mankind occasionally include plaster casts of living people. Placed on these casts are their clothing, the whole being arranged so that it will illustrate their occupations and their relations to the country in which they live as well as its products, both plant and animal.

Frequently pictures or casts or models must be used where the original specimens are too expensive or too large and heavy to be brought to the museum or even too large to be given space in a museum. Then, too, casts may be used for such things as can not be removed from countries which have silly laws preventing their exportation.

The expeditions of a great museum often cover practically the whole world. The American Museum of Natural History in New York in one year had expeditions in many parts of North America, in South America, Asia and the South Sea Islands.

The specimens too valuable for study to be put on exhibition, duplicate collections which are used for study and the specimens for which there is no room in the exhibition halls are kept in rooms for study where they are safe from changes of climate, insect pests,

dust and careless handling. Some of these collections which are never seen by the public, unless they ask to visit the storage rooms, are vast in extent. In a great museum they may be of more value and consist of a larger number of specimens than is found in all the museums put together in a region as large as Canada and the states west of the Mississippi. These collections are of course placed as close together as it is possible to have them and yet be able to get at them for research and for use in illustrating truths to visitors.

When an expedition goes out from a great museum and learns something new, the facts are published in reports which are ofttimes illustrated. This is partly because a single manuscript giving the facts might be burned or lost. These reports are then sent to perhaps a hundred different libraries widely scattered so that they may be available as nearly as possible to all the people of the world. That is, they should be found in such places as London, St. Petersburg, Tokio and Melbourne. It is from such reports that the writers of encyclopedias, text-books and magazine articles secure the knowledge which is finally the common property of all.

A great educational museum always has a library from which its publications are sent out and in which anybody may read works on the subjects covered by the museum. One of the great uses for the museum library is that the staff may always inform itself, for it would not be economical to send an expedition to gather facts about a place if all those facts could be read from books.

After the return of an expedition and after its reports have been published the specimens are put on exhibition together with labels, such a report, popular guide-books, maps, photographs and pictures. Sometimes the results are illustrated by models. Lectures are given to scientific colleagues, to highly educated people, to children, and to the general public, each lecture being made as far as possible appropriate to the audience. The reports contain all the facts, many of which are uninteresting to the public to-day but which would be lost unless published and which may some day be of such great value that they deserve to be saved. These reports are sometimes placed with the exhibits for the use of those who wish to read them, but more often extracts of the more useful and interesting parts are made and published as guide-books for all the people. In some museums such guide-books are given to the public, but as certain classes of people throw them away or destroy them, other museums prefer to charge a small sum for guides. This charge may be less than the cost of the book.

A few museums allow space for special and temporary exhibits and in this way become a sort of headquarters for all kinds of educational expositions such as flower shows, and exhibits illustrating the advance in the fight against the great white plague, expositions of modern sanitary methods and horticultural exhibits. Then too some of the great museums serve as centers for scientific and educational meetings, the large lecture hall being particularly appropriate for general meetings, and the smaller rooms for special societies.

The photographs taken on expeditions are kept in files or in scrapbooks where they may be consulted and copies are given out in small numbers free of cost or in large quantities for the actual cost of the photographs without regard to the expense of the expedition necessary to secure them. These are given to scientists for study and for illustrating their books. They are given to educators to use as illustrations and to hold up before their classes. Many of them are used by magazine writers and newspaper men for illustrations and by sculptors and painters. In this way the explorer brings back glimpses of far-away lands which eventually are shared with people unable to travel or who must travel nearer home.

Vast collections of lantern slides are also maintained in some of the great museums. These are used to illustrate scientific, educational, or entertaining lectures both in the museum and elsewhere. Moving pictures are also occasionally used.

A large lecture hall seating over one thousand people is a useful feature of some of the

great museums which also have as a rule several smaller lecture halls. As many as seven or eight lectures may be held in such a museum in one week, as for instance one for the scientist, three in the afternoons for school children, two in the evenings for the general public, and other lectures for certain special classes of people, as for instance those interested in breeding or sanitation.

All the educational work of the museum exhibits is not confined to the inside of a great museum. Special cases of specimens are prepared and sent out to schools, libraries and other suitable places. Sometimes these are loaned indefinitely but very often they are loaned for a week and then moved to another place. In New York this feature of the work became so extensive that an automobile was purchased to transport the collections from the museum to the schools and from school to school, so that thousands of children were reached. This sort of work is somewhat akin to the work of branch banks and traveling libraries.

Many of our people do not appreciate the real use of a museum and we do not wonder at it when we see the dusty, poorly arranged collections in many museums where there are few, if any, labels and the whole tends to disgust, in fact to teach disorder rather than to be pleasing, helpful or educative, but in an up-to-date museum every day you may see classes from kindergartens enthusiastically examining specimens under the guidance of a museum kindergartner. Frequently one may see classes of bright high-school or college students on a visit to the museum halls, supplementing their educational work by viewing the actual things of which they study. They may be guided by a curator. Thousands of slum children in the greater cities are cheered, educated and uplifted by being taken to the museums by their teachers. One time when a lecture was advertised for school children by an enterprising newspaper which offered a prize for the best essay on a certain subject, over seven thousand children endeavored to attend the lecture held in a hall seating only one thousand four hundred, but one of the museum authorities sprang to his telephone and in as many minutes had twelve of the staff taking as many groups of the children to various parts of the building where they were entertained and instructed.

A great educational museum is usually open free to the public every day in the year so that people engaged on certain days may have the greatest possible opportunity to visit it for recreation, education or research. On the occasion of an exhibit for the prevention and cure of tuberculosis, in one museum over forty thousand visitors passed between the police lines in and out of the exhibit in a single day, which proved conclusively that the public is thoroughly alive to the importance and value of the most modern and useful museum work.

Harlan I. Smith
Geological Survey of Canada

THE PROFESSIONAL WORK OF PROFESSOR MORRIS LOEB[1]

Morris Loeb was a man in speaking of whom I wish I might have had time to choose my words with more deliberation. His nature showed itself always in such a refinement as to command its tracing only with the most delicate touch. Tender is the wound in losing a friend in science whom I had known for nearly twenty years,—in fact, since the time he was the secretary of the Section of Chemistry of the American Association at the Brooklyn meeting. At that time he was participating in the great task of habilitating the American Chemical Society, with the history of which no doubt all here are familiar.

I wish I were able to fittingly tell you of the spirit actuating him at that time, as it proved an inspiration to me then, and afterwards served to cement a friendship into a closer personal relationship.

Born and reared in wealth, a great plan in the business world ready for his acceptance, while gaining a broad culture at Harvard, he inhaled the breath of Wolcott Gibbs's scien-

[1] Presented at the October meeting of the New York Section of the American Chemical Society.

tific spirit, which carried him to Hofmann at Berlin. Three papers were published by him while at Berlin, the last being his dissertation.[2] All dealt with carbonyl chloride and its conduct with various amidines. This work was interesting and possessed that normal importance to the candidate for a degree; but Loeb was not satisfied. That was in 1887. The roving ardor of an awakening of physical chemistry was in the air. It carried him to Heidelberg and then to Leipzig to be with Ostwald, who had just made Arrhenius a real power.

By the advice of Ostwald, Loeb undertook to study the molecular weight of iodine in its solutions by the vapor-tension method.[3] His experimental results led him to conclude:

> It seems very probable that iodine in its red solutions has a molecular weight corresponding to I_4, whilst in the violet solution in carbon disulphide there is a less complex aggregation, giving a value between I_2 and I_3.

He found that the method of determining molecular weights by the depression of the freezing-point is preferable to the method by vapor-tensions. He lacked a liquid which would solidify and also dissolve iodine with a pure violet color; but he endeavored to obtain what corroborative evidence he could by experimenting on the freezing-points of iodine in acetic acid and in benzene, although he was eventually forced to give up the attempt by the very slight solubility of iodine in these menstrua at low temperatures. The molecular weight of iodine as calculated from various series of observations seemed to increase continuously with the concentration, so that there was no point in the narrow limits between extreme dilution and saturation at which the molecular weight would appear constant and could be accepted as trustworthy. This was later confirmed by Paterno and Nasini.[4]

With the intention of testing the then latest views on electrolysis, work in which field he had begun with Gibbs, while still at Leipzig, Loeb, with Nernst, carried on a study of the kinetics of substances in solution.[5] From determinations of Hittorf's ratios of transference and the conductivity of a number of silver salts, they calculated the ionic velocity of silver, according to the principles laid down by Kohlrausch. The constancy of the value obtained from observations with eight different salts gave satisfactory evidence for the truth of the theory, the numbers varying only within very narrow limits. Loeb and Nernst also gave the calculated values for the velocities of the other ions, and it further appeared from a comparison with the temperature coefficients of the velocities that they decrease as the velocity increases.[6]

Loeb then felt ready to come back to the master who had changed his course in life and to tell him what they were doing in Europe. So in 1888–9 he returned as voluntary assistant to Gibbs, who had retired from Cambridge to his private laboratory at Newport. After a year, Gibbs realized Loeb's power as a teacher and made him go to Clark University as docent in chemistry.

In a report on "Osmotic Pressure and the Determination of Molecular Weights,"[7] Loeb discussed Raoult's law, the matured papers of van't Hoff on osmotic pressure, the measurement of osmotic pressure, and the methods of determining the molecular weight from the

[2] These papers were: "Ueber die Einwirkung von Phosgen auf Aethenyldiphenyldiamin," *Ber.*, 18, 2427 (1885); "Ueber Amidinderivate," *Ibid.*, 19, 2340 (1886); "Das Phosgen und seine Abkömmlinge, nebst einigen Beiträgen zu deren Kenntnis," Inaug. Dissert., 15 März I. Chem. Labor. d. Berlin Univers.; *Chem. Centr.*, 58, 635 (1887).

[3] "Ueber den Molekularzustand des gelösten Jods," *Z. physikal. Chem.*, 2, 606; "The Molecular Weight of Iodine in Its Solutions," *Trans. Chem. Soc.*, 53, 805.

[4] *Ber.*, 21, 2153.

[5] "Zur Kinetik der in Lösung befindlichen Körper. Zweite Abhandlung. Ueberführungszahlen und Leitvermögen einiger Silbersalze von Morris Loeb und W. Nernst," *Z. physikal. Chem.*, 2, 948.

[6] Loeb also published in this year a paper on the "Use of Aniline as an Absorbent of Cyanogen in Gas Analysis," *Trans. Chem. Soc.*, 53, 812 (1888).

[7] *Am. Chem. Jour.*, 12, 130–5.

vapor-tension. At this time (1890) experimental data to show the value of Beckmann's method had not been published, but Loeb predicted that it would play as great a part as the freezing-point method introduced in its most convenient form by the same chemist.

Shortly afterwards, in a review, Loeb sketched Arrhenius's hypothesis, with some of its logical consequences.[8] He discussed the physical and chemical objections known in 1890, leaving "the task of judging it . . . to those readers who will compare the mass of experimental material and will convince themselves of the simple relations which the various phenomena appear to bear toward each other. As far as this test is concerned," Loeb maintained, "the hypothesis will be found to fulfill its purposes."

In the exact measurement of electric currents, employing the method wherein the determination of the amount of silver deposited from a neutral solution of a silver salt is made, the source of error, particularly where weak currents are concerned, arises from the imperfect adhesion of the silver upon the cathode. The latter is generally a platinum crucible, and Loeb[9] found that a Gooch crucible with asbestos felting over the holes, was a far better form of cathode, providing an arrangement was adopted to hold the solution during electrolysis without leaking. He attained this very satisfactorily by replacing the ordinary platinum cap with a glass siphon of special form.

Then, when but twenty-eight years of age, he was called to the chair of chemistry at New York University. He published a paper entitled "Apparatus for the Delineation of Curved Surfaces, in Illustration of the Properties of Gases, etc."[10]

Professor Loeb thought that, just as an electric system is affected by its approach to or removal from a magnetic field, a reaction which made a system more or less amenable to magnetic action, might show evidence of acceleration or retardation by the magnetic force. He concluded that if this effect were appreciable, the relation between magnetic force and affinity would be established, and data could be obtained for calculating the real value of magnetization. His experimental results, however, were negative, and he was led to believe that no such relation existed, unless it was so slight that his means of observation were inadequate.[11]

It was shortly after this that I met Morris Loeb. He was fired with the zeal of those captain teachers, and his own lighted torch he passed on by students of his who now reflect, in many responsible positions, that spirit of the eighties.

Soon the very heavy responsibilities of a large inheritance fell upon him. Filial duty of meeting those responsibilities, professorial obligations, and research aspirations required the sacrifice of one of the three. The last was sacrificed for a dozen years. The irksome strain of being "by bells directed" began to tell, for to meet them he found it necessary to have his secretary travel with him to take his dictation. One morning he asked me to go with him to the university. We talked things over and he said he would have to give up the professorship, but he would equip a private laboratory in the old Chemists Club, where he would be nearer his philanthropic obligations and might do some research, and *"other things"* perhaps as useful to chemistry as teaching.

In 1905 he published a research on "The Crystallization of Sodium Iodide from Alcohols."[12] He found that apparently the molecular proportion of alcohol assimilated by sodium iodide decreases as the series ascends. The addition products determined were: $NaI \cdot 3CH_4O$; $NaI \cdot C_2H_6O$, and $5NaI \cdot 3C_3H_8O$.

In 1908, ever keeping abreast with the advances in physical chemistry, in a paper on the "Hypothesis of Radiant Matter,"[13] Loeb

[8] "The Electrolytic Dissociation Hypothesis of Svante Arrhenius," *Am. Chem. Jour.*, 12, 506–516.

[9] "The Use of the Gooch Crucible as a Silver Voltameter," *Jour. Am. Chem. Soc.*, 12, 300.

[10] *Jour. Am. Chem. Soc.*, 13, 263.

[11] "Is Chemical Action Affected by Magnetism?" *Am. Chem. Jour.*, 13, 145–153.

[12] *Jour. Am. Chem. Soc.*, 27, 1019.

[13] *Pop. Sci. Monthly*, 73, 52–60.

enumerated the objections which might be urged against the views which then obtained respecting radio-active processes.

In 1909 he assumed the duties of Chairman of our Section. The task of maintaining the high standard of the meetings set by his predecessor was no mean one, for Baekeland, with his customary enthusiasm, had raised the New York Section to its greatest efficiency. Loeb devoted himself to the welfare of the Section with unremitting energy. I am keenly appreciative of what he did for the Section, as it fell to my lot to take up the task where he left it. The opportunities of the office were increased, for he had enlarged the responsibilities, as well shown in his inaugural address that year.[14]

He did publish (1910) a paper on the "Analysis of Some Bolivian Bronzes" (with S. R. Morey),[15] and he wanted to gratify his great love for research and he did have work in progress in his private laboratory; but, in his characteristic fashion, he sacrificed personal desires to do those things he could do and others could not or were disinclined to do. We are assembled in one of the monumental evidences of this immolition.[16] He made possible the new Wolcott Gibbs Laboratory for Physical Chemistry at Harvard. In the *Proceedings* of the American Chemical Society for 1910[17] he published a beautiful obituary of Gibbs, affectionately respectful, rich in reminiscence and earnest in diction. In this hall we have an evidence of his affection for the master. He visited the South American countries in behalf of the recent International Congress of Applied Chemistry. He worked long and hard on important committees in connection with the congress. These were some of the "*other things*" he found to do for chemistry.

[14] Science, 30, 664.

[15] *Jour. Am. Chem. Soc.*, 32, 652. During 1909–10 Dr. Loeb abstracted the Italian journals for *Chemical Abstracts*.

[16] See Loeb's address at the opening of the Chemists' Club in *Met. and Chem. Eng.*, 9, 177 (1911).

[17] Pp. 69–75.

The shock of Morris Loeb's death still oppresses us; but I am convinced that, as time passes and as we reach a juster evaluation of events, we shall become more and more sensitive of what this man's life really meant, and learn from it what our profession really means. He sought no office; he sought only opportunities to serve his fellowmen. He did it all with a sweet dignity that spells humility. For

Not in hewn stones, nor in well-fashioned beams,
Not in the noblest of all the builder's dreams;
But in the courageous man of purpose great,
There is the fortress, there is the living state.

Charles Baskerville

October 11, 1912

THE GEOLOGICAL SOCIETY OF AMERICA

By invitation of the president of Yale University and the members of its geological faculty and other fellows residing in the vicinity, the twenty-fifth annual meeting of the Geological Society of America will be held in New Haven, Conn., on December 28–31, 1912. The first council meeting is to be held Friday evening, December 27, and the others will be called directly after instead of before the morning sessions as heretofore. Thus the council meetings will cease to interfere with the prompt beginning of the business sessions. The sessions of the society will be held in one of the recitation buildings of Yale University, and the accommodations are so ample that the council is going to try some modifications of the usual program, in an effort to enhance the interest and value of the meeting. The hearty cooperation of the fellowship is needed, however, to make the experiment a success. The morning sessions are to be devoted to papers that promise to be of general interest; the noon recess will be longer than heretofore, in order to give more time for social intercourse, group discussions and the examination of special exhibits; the afternoon sessions will be somewhat shorter than formerly and will be given over to sectional meetings and to papers of less general scope. A special room (or more than one, if needed) will be provided for the display of specimens, the hanging of charts not needed

in the public reading of papers, and for similar purposes. The smoking and general conversation room or rooms will be independent of the foregoing. The annual address of the retiring president, Professor H. L. Fairchild, will be delivered on the evening of Saturday, the twenty-eighth. The council desires to increase the number of students and other junior workers in geological science attending the meeting as visitors, and with this object requests each fellow to send to the secretary, not later than November 25, the names and addresses of persons who, whether they can attend the meeting or not, are seriously interested in geology and deserving of recognition as visitors, although they have not yet reached such standing as to gain membership in the society. The council will then write to the persons thus nominated, inviting them to attend the New Haven meeting.

SCIENTIFIC NOTES AND NEWS

Dr. Edward W. Morley, the distinguished American chemist, has been made an honorary member of the Swiss Association for the Advancement of Science.

The gold medal for science of the Prussian government has been conferred on Dr. Robert Helmert, director of the Geodetic Institute of Potsdam.

Dr. E. J. Bartlett, professor of chemistry in Dartmouth College, has been elected representative to the state legislature from the town of Hanover on the Republican ticket.

Dr. Leo Koenigsberger, professor of mathematics in Heidelberg, celebrated his seventy-fifth birthday on October 15.

The Gedge prize of Cambridge University has been awarded to Mr. A. V. Hill, of Trinity College, for his essay entitled "The Heat Production of Amphibian Muscle and of Cold-blooded Animals."

M. d'Oliveira, the Brazilian ambassador to Belgium, has been delivering a course of lectures in several universities and colleges and has been making a special study of the American collegiate educational system.

Professor Merritt L. Fernald, of Harvard University, lectured before the Geographical Society of Chicago on November 8 on "The Mountains and Barrens of Newfoundland and the Gaspé Peninsula."

Professor H. L. Reitz, of the department of mathematics at the University of Illinois, spoke on "The Mathematical Treatment of Scientific Data" before the first College of Science assembly of the year on November 1. The science assembly will be held monthly throughout the year, following the practise instituted last year.

Dr. Fred. E. Wright, of the Geophysical Laboratory of the Carnegie Institution of Washington, will give a course of lectures on experimental geology to the students of the geological department of the Johns Hopkins University, beginning at the opening of the winter term in January, 1913. Dr. Arthur L. Day, director of the Geophysical Laboratory, will coöperate with Dr. Wright in some of these lectures, the general purpose of which will be to present to advanced students in geology this comparatively undeveloped but highly important branch of the subject, attention being directed to the fundamental principles of chemistry, physics and crystallography which underlie work in this field. The results which have already been secured in experimental geology will be reviewed and attention directed to those geological problems which are still unsolved and in which experiment may render efficient aid.

Professor Harold B. Smith, director of the department of electrical engineering of the Worcester Polytechnic Institute, who is on leave of absence and who has recently returned from a trip around the world, was in Worcester recently and delivered three illustrated lectures descriptive of his travels. The first was before the Alumni Association, the second before the Worcester Polytechnic Institute Branch of the American Institute of Electrical Engineers and the third for members of the electrical engineering department and their friends.

THE Huxley memorial lecture of the Royal Anthropological Institute will be given on November 19, when Professor W. Gowland, F.R.S., will deliver an address on "The Metals in Antiquity."

THE Huxley lecture at the University of Birmingham was delivered on October 30 by Professor John Joly, F.R.S., on "Pleochroic Halos."

A MEMORIAL to Dr. D. B. St. John Rosa was unveiled in the Post-graduate Medical School and Hospital, New York City, of which he was the president from its foundation, in 1881, to his death in 1908. The bronze tablet, which represents in relief Dr. Rosa in academic robes, is the work of Mr. Henry Merwin Shrady.

DR. JOHN WILLIAM MALLETT, F.R.S., professor emeritus of chemistry at the University of Virginia and eminent for his contributions to chemistry, died on November 7, aged eighty years.

DR. JOHN MONROE VAN VLECK, professor of mathematics at Wesleyan University from 1853 until his retirement as emeritus professor in 1904, died on November 4, aged seventy-nine years.

MAJOR GENERAL ROBERT MAITLAND O'REILLY, U.S.A., retired, former surgeon general of the United States Army, died on November 3.

MR. BRADFORD TORREY, the American author of books on natural history, has died at the age of seventy years.

MR. JAMES B. PARKER, of Oxford, known for his work in archeology and geology, has died at the age of seventy-nine years.

MR. WILLIAM BOTTOMLEY, the nephew of Lord Kelvin, who assisted him in his scientific and engineering work, died on October 19, aged sixty-three years.

THE U. S. Civil Service Commission announces an examination for assistant chemist in radio-activity, for men only, to fill vacancies in the Bureau of Mines, at Washington, D. C., or Denver, Colo., at salaries ranging from $1,800 to $2,160 a year. For the same bureau there will be on November 20 an examination for junior alloy chemist at a salary from $1,500 to $1,800.

A Mental Hygiene Conference and Exhibit was conducted at the New York City College by the National Committee for Mental Hygiene and the Committee on Mental Hygiene of the New York State Charities Aid Association. Provision had been made for a large public attendance, and physicians guided parties through the exhibit every half hour, afternoon and evenings. The exhibit, which closed on November 15, was opened on November 8 with addresses by President Finley, Dr. Lewellys F. Barker, Dr. James U. May and Professor George F. Canfield.

WE learn from *Nature* that on October 16 a conversazione was held by the Royal Microscopical Society in the great hall of King's College, about four hundred fellows and guests being received by the president, Mr. H. G. Plimmer, F.R.S., and Mrs. Plimmer. The object in view was, so far as practicable, to gather together a series of exhibits which would indicate the many uses, both in science and commerce, to which the microscope is put at the present time. In addition, the conversazione afforded an opportunity for those engaged in microscopic work to show objects of interest or to demonstrate the use of apparatus or appliances for special purposes.

THE International Photometric Commission, commonly known as the "Zurich Commission," was created by the International Congress of Gas Industries which convened in Paris in 1910. This commission, composed of representatives from the various national technical gas societies, with the cooperation of certain of the national laboratories, has been concerned with general questions of photometry in addition to its more specific functions in connection with the photometry of the incandescent mantle. Inasmuch as there has developed a wide-spread appreciation of the need of an international, thoroughly representative commission to deal with general questions of photometry, and possibly also of illumination, it has been proposed that the International Photometric Commis-

sion be reorganized to fulfill these requirements in a way acceptable to all photometric interests. This movement is being well received, both in Europe and America. President Vautier, of the International Photometric Commission, has requested the sub-commission on photometric units and standards to formulate a plan of reorganization. This sub-commission was originally appointed at the 1911 session of the International Photometric Commission to consider the recommendations of the Illuminating Engineering Society (U. S.) regarding photometric nomenclature and standards. The sub-commission at present is composed of the following members: Dr. Brodhun, Dr. Kusminsky, M. F. Laporte, Mr. C. C. Paterson, secretary, M. Th. Vautier, *ex-officio*, and a representative of the United States soon to be appointed. The personnel of the sub-commission, composed of representatives of the various national laboratories, is peculiarly qualified to undertake the duty of formulating plans of reorganization. It is hoped that as the outcome of the efforts of the sub-commission, with the endorsement of the various national technical gas societies to which the International Photometric Commission in the past has been responsible, an essentially new commission will be formed which will be equally representative of and responsible to all national technical gas, electric and illuminating engineering societies, and other bodies interested in photometry and illumination.

THERE was a decrease of nearly 28 per cent. in the production of iron ore and a smaller but noteworthy decrease in the production of pig iron and steel in the United States in 1911, compared with the production in 1910, due to the large over-production of ore in 1910, and to a lessening demand for iron products in 1911. The prospects for 1912 are encouraging, according to Ernest F. Burchard, of the United States Geological Survey, in a report on the "Production of Iron Ore, Pig Iron and Steel in 1911," but at no time since 1907 has the excessive capacity for manufacturing iron and steel been fully utilized, and nothing short of abnormal activity, which is not likely to occur in 1912, will result in employing the full capacity of the plants. One of the important features of the iron-ore industry in 1911 was the increased attention paid to the conservation of ore in the Lake Superior region through beneficiation (washing, concentrating, roasting, nodulizing and briquetting of ores). The iron ore marketed in the United States in 1911 amounted to 40,989,808 long tons, valued at $86,419,830 at the mines, compared with 56,889,734 long tons, valued at $140,735,607, in 1910. Minnesota and Michigan produced the bulk of the iron ore, the former 23,398,406 long tons and the latter 8,944,393 long tons. During the year 159 mines produced over 50,000 long tons of iron ore each, compared with 191 mines which exceeded that output in 1910. The largest quantity produced by any single mine in 1911 was 1,553,510 long tons, from a mine at Marble, Minn. The production of pig iron in 1911 amounted to 23,257,288 long tons, valued f. o. b. at the furnaces at $327,234,624, compared with 26,674,123 long tons, valued at $412,162,486, in 1910, a decrease in quantity of 3,416,835 tons and in value of $84,827,862. Pennsylvania produced the greatest quantity of pig iron, 9,581,109 long tons; Ohio was second, with 5,371,378 long tons, and Illinois stood third, with 2,036,081 long tons. The total quantity of steel produced in 1911 was 23,675,501 long tons, against 26,094,919 long tons in 1910. The bulk of it came from Pennsylvania, whose output was 13,207,539 long tons.

THE United States Geological Survey has recently published, as an advance chapter from "Mineral Resources of the United States for 1911" a report on the mine production of silver, copper, lead and zinc in the central states in 1911, by B. S. Butler and J. P. Dunlop. The total value of the output of these metals in the central states in 1911 was $64,519,444, nearly half of which came from Missouri, whose production was valued at $30,171,311. The value of the output of Michigan, the second largest producer, was $27,743,572. The production of silver in the central states in 1911 was 550,184 fine ounces, valued at

$291,598, compared with 365,702 fine ounces, valued at $197,479, in 1910. Of the 1911 production 497,281 ounces came from the copper lodes of Michigan. The output of copper from the central states in 1911 came from the states of Michigan and Missouri and amounted to 220,480,513 pounds. Of this production 219,840,201 pounds came from Michigan. The mine production of lead in the central states in 1911 was 188,669 short tons, which, rated at the average New York price for the metal for the year ($90 a ton), was valued at $16,980,210, compared with 171,226 short tons, valued at $15,067,888, in 1910. Missouri produced 95 per cent. of the yield of the central states and about 44 per cent. of the primary lead recovered in the United States from domestic ore. The production of zinc in the central states in 1911, based on mine returns with a deduction for separating and smelting losses, was 172,698 short tons, valued at $19,687,572; the production for 1910 was 178,784 short tons, valued at $19,308,672. Missouri was the largest producer of zinc in the United States, although its production, 122,515 tons, was slightly less than in 1910.

UNIVERSITY AND EDUCATIONAL NEWS

WORK has been begun at Harvard University on the three freshman dormitories which are to stand near the bank of the Charles River, south of the main body of university buildings. It is understood that Mrs. Russell Sage is one of the large contributors to the fund of $1,800,000 which is now nearly completed for these dormitories.

GROUND has been broken for the north wing of the new electrical laboratory of the Sheffield Scientific School. It will cost about $115,000, of which $75,000 is a gift made by A. C. Dunham, Yale, '54, of Hartford, Conn.

THE trustees of Wesleyan University have voted to build an astronomical observatory at a cost of $60,000.

THE Queen Wilhelmina chair in Dutch history, literature and language will be established at Columbia University, supported jointly by the university and by funds raised for the purpose in Holland.

THE first event in the opening of the Peter Bent Brigham Hospital at the Harvard Medical School was the opening of a class for nurses in the ward building on October 31. On the same date the hospital took over the Harvard Clinic, which will be the first continuous clinic in Boston. Patients will be admitted to the hospital about the middle of January.

ON October 23 the corner stone of the library and administration building for the University of Utah was laid with appropriate ceremonies. This building is to occupy the central position at the head of the street upon which the campus faces. The superstructure will be of Sanpete oolite, and the foundation of Temple granite from Little Cottonwood Canyon. When completed it will house the library, the administrative offices, the art gallery, the archeological museum and a spacious auditorium, as well as rest rooms for men and women. The cost will be more than $300,000.

A RECENT analysis of the professional distribution of the graduates of Oberlin College reveals the fact that teaching has been the most prominent field of endeavor. The total number of graduates of the academic department, including men and women, is 3,385 (when the same person has taken more than one degree he has been considered but once). Of these, 1,244, or 36.8 per cent. have gone into the profession of teaching. If the group of unclassified is left out of consideration, thus omitting many women with no profession, the proportion of graduates entering teaching is even more striking, since one out of every two has become a teacher. From a total of 1,682 men graduating from the academic department, 392, or nearly 25 per cent., were teachers. Of the women, 853 out of a total of 954 classed in any profession have taught.

PROFESSOR T. J. HEADLEE, head of the department of entomology and zoology in the

Kansas State Agricultural College and Experiment Station, has resigned to become state entomologist of New Jersey, succeeding the late John B. Smith. In Dr. Headlee's place at the Kansas College and Experiment Station, Geo. A. Dean, M.S., has been placed in charge of entomology and Robert K. Nabours, Ph.D. (Chicago), in charge of zoology. Further promotions and additions in the department have been as follows: John W. Scott, Ph.D. (Chicago), has been promoted from instructor to assistant professor of zoology; Maurice C. Tanquary, Ph.D. (Illinois), has been appointed instructor in entomology, and Mary T. Harmon, Ph.D. (Indiana), in zoology and J. W. McColloch has been appointed assistant entomologist.

Dr. C. J. Steinmetz, formerly managing editor of *Country Life in America*, has been appointed assistant professor of landscape horticulture at the University of Illinois, and Ralph Rodney Root, of Harvard University, has been appointed instructor. A number of prominent specialists in landscape gardening will lecture before the students this year; Mr. Charles Mulford Robinson, a specialist in city planning, will lecture for two weeks beginning on November 8. There are thirty students in the four-year course in landscape gardening and one hundred and fifty in the elementary course.

The vacancy in the staff of the mechanical engineering department of Lehigh University, due to the death of Assistant Professor E. L. Jones, has been filled by the appointment of R. L. Spencer, B.S. Mr. Spencer is a graduate of the Iowa State College, where he has taught for three years.

Bartgis McGlone, Ph.D. (Hopkins, '07), has been appointed associate in physiology and embryology at the College of Physicians and Surgeons, Baltimore.

Among the committees appointed by the board of overseers of Harvard University for the year 1912–13 are the following:

The Medical and Dental Schools—J. Collins Warren, George B. Shattuck, Charles W. Eliot, Alexander Cochrane, William Sturgis Bigelow, Henry H. Sprague, Henry Saltonstall Howe, William L. Richardson, Charles P. Briggs, James C. White, Charles H. Tweed.

The Bussey Institution—Carroll Dunham, Walter C. Baylies, J. Arthur Beebe, John Lowell, Nathaniel T. Kidder, Augustin H. Parker, William H. Ruddick, Isaac S. Whiting, Simon Flexner, Daniel W. Field, Warren A. Reed.

The Observatory—Joel H. Metcalf, George I. Alden, Mrs. Henry Draper, Edwin Ginn, George R. Agassiz, Elihu Thomson, Erasmus D. Leavitt, Charles F. Choate, Jr., Charles R. Cross.

The Museum of Comparative Zoology—J. Collins Warrent, George P. Gardner, Dudley L. Pickman, Rodolphe L. Agassiz, John C. Phillips, J. B. Henderson, Jr., Louis J. de Milhau.

The Peabody Museum—George D. Markham, Charles P. Bowditch, Augustus Hemenway, Jesse W. Fewkes, Clarence J. Blake, Clarence B. Moore, Elliot C. Lee, Louis J. de Milhau, John C. Phillips, Thomas Barbour, Robert G. Fuller.

The Jefferson Physical Laboratory and Department of Physics—Howard Elliott, Elihu Thomson, Erasmus D. Leavitt, Elliot C. Lee, Samuel Hill, Hammond Vinton Hayes.

The Chemical Laboratory—J. Collins Warren, Clifford Richardson, Elihu Thomson, Charles H. W. Foster, John D. Pennock, Alexander Forbes.

On Geology, Mineralogy and Petrography—George B. Leighton, Rodolphe L. Agassiz, George P. Gardner, William E. C. Eustis, Raphael Pumpelly, William Sturgis Bigelow.

On Zoology—William L. Richardson, Augustus Hemenway, William Brewster, Alexander Forbes, John E. Thayer, Dudley L. Pickman, Francis N. Balch, John C. Phillips.

On Botany—Nathaniel C. Nash, George G. Kennedy, Walter Deane, Edward L. Rand.

On Mathematics—William Lowell Putnam, George E. Roosevelt, George V. Leverett, Philip Stockton.

DISCUSSION AND CORRESPONDENCE

THE MEANING OF DRIESCH AND THE MEANING OF VITALISM

Professor Jennings's letter in Science of October 4, 1912, contains some comments on an article by the present writer, published in Science, July 21, 1911. These appear to manifest some misapprehension, confirmed by some inadvertent misquotation, of the article in

question; and to convey, accordingly, an erroneous impression both as to what was said, and as to what is the fact, concerning Professor Driesch's view of the relation of vitalism to indeterminism.

With respect to the article upon which he animadverts, Jennings declares or plainly implies: (1) that it purports to be an account of Driesch's personal views concerning the relation of vitalism to "experimental indeterminism," but that what it gives "is in reality an exposition of the conclusions which Lovejoy himself might draw from Driesch's data, assuming these to be the conclusions which Driesch draws"; (2) that in consequence of this confusion the article erroneously maintained that Driesch is not an "experimental indeterminist." Both these assertions require correction.

1. The article expressly distinguished between Driesch's actual views as a whole, and the conclusions which I regard as properly inferrible from a single one—though the most emphasized and most characteristic one—of his arguments. For the exposition of the former I disclaimed responsibility, remarking that I did "not wish to complicate the discussion with exegetical inquiries into the precise meaning of a rather difficult writer." My discussion was explicitly limited to the morphogenetic data brought together in "The Science and Philosophy of the Organism," to the exclusion of the arguments from animal behavior, which are more markedly indeterministic in their tendency. I endeavored to point out the real "conclusions suggested by Driesch's analysis of what is implied by the totipotency of parts," etc., to show "all that it logically *need* imply"; and the reader was definitely informed that these logically necessary implications of Driesch's premises fall short of the conclusions which he at times deems himself entitled to draw.

I do not say that Driesch himself clearly and consistently adheres to this assumption [*i. e.*, that his entelechies, supposing them to exist, act in a uniform manner and in correlation with specific physico-chemical complexes]; but in so far as he departs from it and gives color to the charge of indeterminism, he introduces a foreign element into his conception of a "harmonious equipotential system," and confounds the second sort of vitalism with yet a third essentially distinct one [*i. e.*, with experimental indeterminism]. And this is one of the confusions which it is needful to guard against in the discussion (p. 78).

The reader of Jennings's recent letter would certainly gather that I had failed to make this distinction, and would never guess that the article under discussion contained such a passage as that just cited. Jennings, in fact, takes from the article sentences referring to what I urged were the only proper inferences from Driesch's premises, divorces these sentences from their context, and cites them as evidences of my misconception of the actual and total position personally held by Driesch. He quotes, for example, the phrase "a closer scrutiny of the doctrine's implications," etc.; the "doctrine" here referred to is *not*, as he assumes, Driesch's entire system of vitalism, but a more limited doctrine, formally defined in the preceding paragraph.[1] In two other cases Jennings cites disconnected sentences and assigns the demonstrative pronouns in them to antecedents other than those intended.

2. It is, however, true that two passages in the article referred directly to Driesch's actual position. One of these, already quoted, consisted in the admission that Driesch in fact, though without warrant from his premises, at times construes his vitalism as equivalent to experimental indeterminism. The other was an *obiter dictum:* "though I think Jennings misconceives Driesch's position in ascribing to him a wholesale 'experimental indeterminism,' I do not wish," etc. Against this Professor Jennings now quotes letters from Professor Driesch in which the latter frankly calls himself an experimental indeterminist. Since I had elsewhere in the article noted that he

[1] It was to this kind of vitalism, as defined in my earlier paper—"the second kind of vitalism distinguished by Lovejoy"—as well as to Driesch's personal doctrine, that Jennings in his previous article imputed indeterministic implications (SCIENCE, June 16, 1911, pp. 927–28).

was such in some sense and to some degree, I should have supposed that Professor Jennings would have given consideration, in reading this phrase, to the qualifying adjective "wholesale." By a "wholesale indeterminism" I intended to designate precisely that extreme doctrine which Jennings in his paper had apparently ascribed to the author of "The Science and Philosophy of the Organism." That doctrine Jennings had formulated as follows (italics mine):

All living things are complexes of great numbers of chemicals so that *the conditions under which entelechy comes into play are always realized.* We may therefore *expect its action at every step in our work;* we must be prepared *at all times to find the same physical configuration giving rise now to one result and now to another.* (SCIENCE, June 16, 1911, p. 932.)

Such a view would mean that, in organisms, not merely behavior but also all morphogenetic and psychological processes would be absolutely variable and unpredictable, that no amount of past experience of vital phenomena would justify even the slightest anticipation of any uniformity in their future sequences. This doctrine, if accepted, would, as Jennings rightly points out, make biology as a science impossible and compel us to regard biological investigators as engaged in a "hopeless task" (*ibid.*). If Driesch adheres to this "wholesale experimental indeterminism," and takes this extreme view of the impossibility of generalization and prediction in biology, I must frankly confess that I had *not* gathered the fact from his Gifford lectures. And I must add that I even yet remain unconvinced that he does so. If he does, he ought in consistency to lead a movement for the suppression of physiological laboratories. I am strengthened in my disbelief that Driesch cherishes any such fell designs against the happiness of experimental investigators in biology by the fact that another letter of his to Professor Jennings—which the latter does not quote, but which he has kindly permitted me to see—contains the following words:

Practically, we may say that complete knowledge of the physico-chemical constitution of a given egg in a given state and of the behavior following this constitution in one case, implies the same knowledge for other cases (in the same species) with very great probability. But this is a probability *in principle* and can never be more. It would not even be a probability, in the case that we did not know the origin (or history) of a given egg in a given state, viz., that the egg is the egg of, say, an ascidian. But to know this history or origin *is, of course, already more than simply to know "the physico-chemical constitution"* and its consequences in one case (what suffices in the realm of the unorganic). It *may* be that the eggs of fishes, echinides and birds are the same in all *essentials* of the physico-chemical constitution.[2] There happens something very different in the different cases on account of the different "entelechies." In spite of this, we know what will happen with great probability from one case if we know that this egg "comes from a bird" and that the other "comes from an echinid." . . . Therefore, *practically,* "experimental indeterminism" is not a great danger for science. [Italics in the original.]

This appears to me to be a tolerably pertinent passage, which might well have been included among Jennings's selections from his correspondence with Driesch. It seems equivalent to a statement that the sort of indeterminism which Driesch professes is virtually negligible, so far as the every-day, practical purposes of the experimentalist are concerned. If Jennings had considered this passage in connection with the others which he quotes, he would not, I am sure, have contended that "Dr. Driesch's statements of the matter are fully as strong" as his own: they obviously fall very far short of his own. The experimental indeterminism in them is not at all of the "wholesale" sort.[3] Possibly Jennings holds

[2] The reader will observe that this particular proposition Driesch gives as merely possibly true. It has, in fact, no sort of logical connection with his arguments from morphogenesis and restitution. Not only do those arguments not prove this conclusion, they do not even suggest it.

[3] In published writings Driesch uses language which seems to express a yet more definite repudiation of wholesale experimental indeterminism. Thus in *Die Biologie als selbständige Grundwis-*

that one who admits that there is any "experimental" indeterminateness in any organic process can not consistently stop short of the extreme view he has himself defined. But he has scarcely proven this; and in any case, if he imputes the acceptance of this view to Driesch, he is identifying the conclusions which he himself might draw from certain of Driesch's positions (if he held them) with the conclusions which Driesch draws.

I am afraid the foregoing shows that Professor Jennings has, after all, succeeded in luring me into "exegetical inquiries into the precise meaning of a rather difficult writer." However interesting these may be, there are other questions in which, I confess, my interest is more acute—as, no doubt, Professor Jennings's really is also. Among these is the question: What do the data chiefly emphasized by Driesch *really* tend to prove about organisms? On this, which was the principal theme of my previous communication on the subject in SCIENCE, Professor Jennings's recent letter has little to say. Yet I think that his letter leaves the matter in a not wholly satisfactory logical condition; and that there is a good deal more which might with advantage be said, in the interest of a full clearing up of this genuinely significant issue. But that undertaking, to which I hope before long to attempt to contribute elsewhere, would call for a lengthier disquisition than would be suitable for publication in this journal.

ARTHUR O. LOVEJOY

THE JOHNS HOPKINS UNIVERSITY,
October 15, 1912

senschaft, 1911, he defines biology as a *Gesetzeswissenschaft*, which has for its most fundamental part "the doctrine of the laws of morphogenesis." And he speaks of these laws as discoverable through *gewisse Sondererfahrungen*. Vitalism, he adds, "never means *Gesetzlosigkeit*" (pp. 34, 37, 39).

WINTER WEATHER IN FLORIDA

UNDER the above caption in SCIENCE for May 31, 1912, Mr. Andrew H. Palmer submitted some observations on Florida weather. The winter of 1911–12, in Florida, was by no means severe, but the temperature averaged low during January and February, as compared with the normal, the monthly departures during the winter months being: December, $+5^{\circ}.1$; January, $-0^{\circ}.6$, and February, $-4^{\circ}.6$.

Mr. Palmer's statement that "Florida's climate did not receive careful attention until large numbers of settlers were attracted by the recent land-boom," is rather gratuitous. For forty years the weather bureau records of Florida have been consulted by people of broad intelligence in their search for truth, regarding the climatology of the state. With regard to the statement: "In all but eight of the last seventy years freezing temperatures have occurred in Jacksonville," a few supplementary facts are essential to a correct understanding. Mr. Palmer's figures were correctly copied from "Climatology of the U. S.," but included in that report were miscellaneous records that antedate those of the weather bureau, and, though given official cognizance to the extent of publication, yet, the official life of local weather bureau data begins with the establishment of a station in Jacksonville in 1871. The records previous to 1871 were mostly by voluntary observers, and they are not recognized as coordinate in importance with those compiled under official supervision during subsequent years; hence, to a certain extent, they are taken *cum grano salis*. A freezing temperature in Jacksonville is not followed, necessarily, by similar conditions in the citrus belt for Jacksonville sustains, approximately, the same relation to the rest of the state as Sacramento, California, does to the San Diego section.

The above qualifications are pertinent also in the matter of snowfall in Florida. During the severe blizzard of February, 1899, snow fell over the extreme northern portion of the State to the depth of several inches; that is, over an area of slightly more than 1° in latitude. This was the heaviest snow fall in Florida of which there is authentic record, and it is believed to be an expression of maximum intensity along that line. Certainly it was not exceeded during the century.

Mr. Palmer points out further: "The St. Johns River was frozen." My, that was a cold wave, indeed! The St. Johns River is from 1 to 5 miles wide, and 20 to 40 feet deep, with the usual tidal conditions that obtain in streams contiguous to the ocean. That this river, in latitude 30° North, should freeze over is a new science item of wonderful potentiality. Ice may have formed near the fringe of the river during the severe weather of 1835, but the St. Johns freezing, never! "Climatology of the U. S.," by Professor Henry, stated: "The St. Johns was frozen several rods from the shore," quite a distinction from: "The St. Johns was frozen."

As to the formation of frost at Miami on February 11, 1912, as alleged by Mr. Palmer, it is sufficient to say that the minimum temperature at Miami on the date named was 51°.

Florida covers an area of about 6° in latitude. Winter storms of the southwest type occasionally dip far southward, and, when followed by "highs" of great magnitude, it is obvious that wide temperature ranges must be the sequence to the rapidly shifting areas of high and low barometric pressure. Be it remembered, however, that most of the cold waves that reach the gulf coast leave no icy touch over the lower peninsula. The great upper drift seems to pull the northern portion of our "highs" more rapidly eastward than the southern portion, thereby frequently converting what appeared, primarily, as an ominous condition into a harmless change of northeast winds and cloudy weather.

In contrasting Florida and California as winter resorts, Mr. Palmer was unfortunate in his citation of temperatures, and, inferentially at least, left the impression that California, during the winter of 1911–12, was the elysian field of climatic perfection. Invidious comparisons are not in good taste, but weather bureau records are paths that lead to truth, so let the record speak. Mr. Palmer states that 42° was the lowest temperature recorded at Los Angeles during January. Official records show, however, that 39° occurred on February 27, and 38° on December 31, 1911, and these figures represent a state of inversion, the temperature nearer the ground being 8° to 10° lower. In fact, Riverside recorded 21°, San Bernardino, 19°, and Redlands 24°, on December 26, 1911. The temperature of —2° at Tallahassee, Fla., in February, 1899, occurred during a condition that marked an epoch in the climatic history of the country. Tallahassee, however, is in the "hill country," quite 200 miles from the citrus belt. Coincident with the zero temperature at Tallahassee, were minima of only 24° to 28° in what is now an important section of the citrus belt.

Parenthetically, I will say there is no issue between California and Florida. Their inheritance and common destiny are the same. Florida rejoices in California's countless resources and great prosperity, and forsooth, she has learned a lesson from her business acumen and studied frugality. Aye, more. Florida is even willing to follow where California leads, provided the objective be unity and prosperity, justice and equality.

Florida's hopes and aspirations are not builded on the misfortunes of others, but, like California, they rest securely in the public's knowledge of her resources, and in the wonderful possibilities arising from a climate that offers success to the industrious, hope and comfort to the afflicted.

Florida, however, has her "ups and downs." The cold wave of December, 1911, so damaging to the Pacific coast, did not reach this state, but its counterpart is found in the cold waves of the '90's, which swept this section with great severity.

The matter of the weather recurring in cycles has not been established as a fundamental fact, Bruckner to the contrary, notwithstanding. The "long ranger" has spent his force, and until puny man is able to revolutionize the mechanics of the atmosphere, the rain-maker will continue to bombard space with negative results. Hence, we must continue to rely on that governmental agency, the weather bureau, for timely warnings of impending changes. Light-wood knots are still plentiful in Florida, and coal and oil seemingly so in California. The utilization of

these, supplemented by intelligent action, will circumvent, to a large extent, any lasting damage from even extreme boreal conditions.

A. J. MITCHELL JACKSONVILLE, FLORIDA

SCIENTIFIC BOOKS

The Life of Ellen H. Richards. By CAROLINE L. HUNT. Boston: Whitcomb and Barrows. 1912. Pp. xiv + 329.

It is seldom that a biographer is confronted with a more difficult task than that of bringing together in moderate compass a record of a life of such unremitting, aggressive and varied activity as that of Ellen Henrietta Richards. In this instance, however, both author and publishers have been inspired by warm, personal friendship to prepare a memorial which should give worthy expression to the ideals, purposes and deeds of this most remarkable woman, and the outcome is a volume which will gratify the legions of those who, because of personal contact or helpful inspiration, will always count Mrs. Richards among their friends.

The preparation of this memorial volume was undertaken, at the request of Professor R. H. Richards, through the cooperative efforts of a committee of nine of Mrs. Richards's intimate associates. They have gathered materials from many sources, including family records, letters from classmates, college associates, graduates and former students of the Massachusetts Institute of Technology, friends in all walks of life, and from the officers and records of the many organizations in whose activities she took a leading part. From this material Miss Hunt has prepared a most readable and interesting narrative. This she has subdivided into sketches, in separate chapters, relating, respectively, to Mrs. Richards's childhood, girlhood, college life (two chapters), her experiences as a student of chemistry, her laboratory work, her home life, her association with the Woman's Laboratory, her teaching by correspondence, the beginnings of euthenics, her work among and for college women, her activity as a missionary of science, her journeyings, her activities in connection with the Lake Placid Conference, and with the Home Economics Movement. The remaining two chapters of the book deal with the enlarged influence of the last years of her life and the fortunate perpetuation of that influence in the future through the continuation of the helpful activities which she organized and inspired, and which others are now maintaining with enthusiasm.

It is obviously too early to estimate accurately the full measure of what Mrs. Richards accomplished, but this disadvantage is more than offset by the opportunity to obtain accurate information at first hand from many reliable sources, and by the enthusiastic zeal of so many to do honor to the memory of one who had so recently been to them a source of inspiration and help.

Even to those most closely associated with Mrs. Richards, who witnessed her untiring energy and devotion to her work and her ideals, the story of her life, as told in this volume, must excite renewed wonder and respect. It is a singular record of severe and often disheartening obstacles overcome by patient purpose and ceaseless effort, inspired and supported by a breadth of thought and outlook which was distinctly in advance of the period in which she was working. This is strikingly true of her girlhood and young womanhood, where she was a pioneer in her undertakings with respect both to her own education and development and that of her fellow-women; and it is hardly less true of the work of her later years for the improvement of life in the community, and especially in the home. Her viewpoint had much in common with that which in other fields leads to the inception of large engineering operations of wide significance. Whether as teacher, investigator, organizer, missionary, companion or friend, her efforts were essentially constructive, and, while the results may lack something of the tangible permanence and glory which belong to the creations of the engineer, they are none the less abiding and real. It is a pleasure to note that two memorial funds, the proceeds of one of which is to be used for the endowment of research

along those lines of the chemistry of sanitation in which she was interested, and the other to be used in the interests of Home Economics, are already of considerable size, and, if still further supported, will do much to perpetuate her life work.

If the zeal of the biographer has occasionally (though seldom) led to the use of ultra-superlatives, it is far more frequently true that, in the compass of such a work as this, it has been impossible to do full justice to her attainments in so many fields. The volume is amply illustrated (the frontispiece being a most excellent photograph of Mrs. Richards, taken near the close of her life) and it can hardly fail to be a source of gratification to all concerned with its preparation. It is a book which should be widely read and from which much pleasure and profit is sure to be derived.

H. P. Talbot

The Examination of Prospects. A Mining Geology. By C. Godfrey Gunther. New York, McGraw-Hill Book Company.

This book, which is attractively bound in flexible leather as a pocket manual of 221 pages, presents the practical side of the geology of metalliferous ores, excepting iron and placers. Sound advice is given on the procedure of the examination and sampling of mines, and especial attention is devoted to the outcrops and structural features of ore deposits.

The writer states at the outset that a great proportion of the deposits having outcrops of commercial grade or of evident promise have already been recognized and explored. Rich discoveries at the surface belong to pioneer days, and as time goes on the more important developments are the result of lower working costs, improved metallurgical processes, and of an increasing knowledge of economic geology. As engineers in search of developed mines no longer expect to find properties having positive ore of greater net value than the price asked, so those in search of prospects should not expect to find proved ore-shoots awaiting their recommendation. There is usually local capital for the preliminary development of a patently good prospect, and most of these are steadily worked from the time of their discovery until some apparently unfavorable development shuts off the supply of local capital. These statements recall one frequently heard that "all mines are poor at the bottom." The basis is partly geological and partly psychological, for men seldom stop digging when in bonanza. A great majority of prospects have been examined again and again, presumably by men who commanded a knowledge of sampling, the services of an assayer, and at least an elementary knowledge of geology. In order to pick a good prospect from those rejected by his predecessors, therefore, an engineer must base his hope of success upon superior geological training.

Although the author does not attempt a genetic classification of ores, he does present in a logical and effective manner a mass of carefully chosen and ably digested material.

The treatment of the superficial alteration of ore deposits and the secondary enrichment of copper, silver and gold ores is concise and clear; but in view of Stokes's experiments in the solution of gold in ferric salts, the statement that gold is dissolved in solutions of ferric hydrate would seem to demand experimental proof. Numerous examples are cited of changes in value and character that have been noted as ore lodes are followed in depth. The many text figures, which are well chosen and well executed, add greatly to the attractiveness and value of the volume, and both the author and publisher are to be congratulated on its appearance.

W. H. Emmons

Minneapolis

SPECIAL ARTICLES

NOTE ON THE DEVELOPMENT OF AMPHIBIAN LARVÆ IN SEA-WATER

That the amphibia are poisoned by common salt, and hence geographically restricted to regions free from this substance, is a general belief, apparently so well supported by observa-

tion and experiment, that the contradictory evidence brought forward recently by Pearse[1] seems at first sight enigmatical. However his discovery of frog larvæ in three pools of an estero, or small creek opening into Manila Bay, is capable of explanation although, because of osmotic difficulties, it is impossible to carry out the necessary experiments quantitatively on forms which do not live equally well in fresh and salt water.

The three analyses reported by Pearse are not strictly comparable, and in the calculation of the NaCl from the total Cl no standard of reference is given, nevertheless it follows from recalculation on the basis of Forchheimer, that the solutions dealt with must have been, as stated by Pearse, roughly, 2.6 per cent., 2.1 per cent. and 1.1 per cent. NaCl respectively.

As the larvæ were found in a tidal area where fresh and salt water meet, it is not probable that they were exposed continuously during their development to the amounts of NaCl given, but it is probable that they developed in a medium never free from this salt, and that despite the fact that .6 per cent. is ordinarily sufficient to prevent gastrulation.

Acclimatization to Osmotic Pressure.—A dilution of .85 per cent. NaCl (.25 per cent. less than the weakest solution reported) causes the death of 87 per cent. of the larvæ of *Rana pipiens* exposed to it for eighteen hours, whereas a solution of twice this strength kills 97 per cent. in three hours, and is therefore six times more fatal than the weaker solution. This fatality, however, depends on osmotic pressure, for both solutions brought about shrinkage, and an associated slowness and feebleness of reaction to touch. In the stronger solution these symptoms were more pronounced, and came on more quickly than in the weaker. Death resulted, therefore, probably more from dehydration than from the specifically poisonous effects of the NaCl.

These results led to an attempt at acclimatization by successively halving the .85 per cent. solution, until only one sixteenth its original strength. With this three series of tests were begun, involving fifteen larvæ. The results are given in tabular form as follows:

After	32	21	24	24	24	hours
in NaCl	.053125	.10625	.2125	.425	.85	per cent.
there were	15	14	12	10	0	survivors.

Time of acclimatization 101 hours.

Average strength of preparatory solution .199 per cent.

From control observations I found that 24 hours is just about the limit of endurance in the .85 per cent. solution, whereas without acclimatization 18 hours is the limit. Life, therefore, can be prolonged one third by a preliminary slow passage through weaker solutions. From this I conclude that the ability of amphibian larvæ to exist in sea water depends on their not being introduced into the stronger solutions too suddenly. This desideratum can certainly be fulfilled in an estero. These experiments leave entirely open the question of racial acclimatization which is probably of great importance.

The Antagonistic Effects of Calcium.—As Loeb[2] has repeatedly pointed out, very small quantities of Ca suffice to antagonize the poisonous effects of NaCl. Thus he found that in 100 c.c. of 5/8 M NaCl the eggs of *Fundulus* failed to develop, whereas when he added 4 c.c. of an M/64 $CaSO_4$ solution, 75 per cent. of the eggs formed embryos. From this it follows that one molecule of $CaSO_4$ is sufficient to antagonize 1,000 molecules of NaCl. It does not of course necessarily follow that this will prove true with other organisms, nor must we forget that other ions have been shown to antagonize the Na, but the antagonism of the Ca against the Na is so strong in the case of *Fundulus* that it is only natural to try this first in the case of the frog larva.

[1] Pearse, A. S., "Concerning the Development of Frog Tadpoles in Sea Water," *Philippine Journal of Science*, Vol. VI., No. 4, Section D.

[2] "Dynamics of Living Matter," p. 47.

The deleterious effect of a 1.7 per cent. NaCl solution to which .09 per cent. $CaSO_4$ had been added proved, as one might expect, greater than that of the pure NaCl solution. Even when diluted one half 93 per cent. of the larvæ died in 13 hours. However, preliminary treatment with more dilute solutions, even for a relatively short time, not only practically doubled the time during which the larvæ can endure the .85 per cent. solution, but only 7 per cent. died in 24 hours. In tabular form:

After	12	11	11	24	hours
in NaCl	.10625	.2225	.425	.85	per cent.
in $CaSO_4$	.005625	.01125	.0225	.045	per cent.
there were	15	15	15	14	survivors.

Time of acclimatization 34 hours.
Average strength of preparatory solution in Na .248 per cent.
Average strength of preparatory solution in Ca .013 per cent.

Comparing this result with the first acclimatization, it is seen that when Na and Ca are present roughly in the proportion of 50 to 1, the tadpoles may be acclimated to the .85 per cent. solution about three times as fast as in the absence of the Ca, and furthermore that 93 per cent. of the larvæ so treated can endure this solution for 24 hours, whereas, in the absence of Ca, none survive. Although the concentrations here dealt with are lower than those reported by Pearse, although not much lower than his weakest solution, the proportion of Na to Ca is, according to Forchheimer, identical.

Other Antagonisms.—In a series of investigations Loeb and Wasteneys[3] have demonstrated and measured the antagonistic effects of KCl and NaCl on *Fundulus,* so that in view of the fact that the findings with reference to Ca can be verified on the frog larva, it seems reasonable to assume similar relations for the K and Na. For Mg this is certainly true, although its antagonism to Na is much less marked, as the results given below show.

After	24	24	35	21	24	hours
in NaCl	.053125	.10625	.2125	.425	.85	per cent.
in $MgCl_2$	.0053125	.010625	.02125	.0425	.085	per cent.
there were	15	15	15	15	0	survivors.

Time of acclimatization 104 hours.
Average strength of preparatory solution in Na .199 per cent.
Average strength of preparatory solution in Mg .0199 per cent.

Comparison with the results with pure NaCl shows that the presence of the Mg enables the larva to withstand a solution of increasing concentration with average strength of .199 per cent. NaCl for 104 hours without a single death, whereas in the absence of Mg, 33 per cent. die in 101 hours. Both in the presence and absence of Mg, however, there were no survivors in the .85 per cent. solution after 24 hours, which shows that the Na–Mg antagonism is less pronounced than that between Na and Ca.

While these experiments give some insight into the conditions of survival for frog larvæ in sea water, the actual circumstances are probably not as simple as one might at first conclude, for granted an antagonistic action between Na and K, Na and Ca, and Na and Mg, it does not follow that in a solution in which all these salts are present, the total antagonistic effect toward Na could be represented by the formula, Na *vs.* (K + Ca + Mg) for ions capable of antagonizing the Na may antagonize each other. The existence of these "accessory" antagonisms has been demonstrated by Loeb and Wasteneys for *Fundulus.* In the case of the frog embryos I found an antagonistic action between Mg and Ca, for although both these ions antagonize the Na, yet a solution containing all three is a less

[3] *Biochemische Zeitschrift,* Bd. 31 and 32.

favorable one for the embryos than one containing only Na and Ca. The experiments on which this statement is based are tabulated below and can be compared with the earlier ones.

After	21	21	25	24	24	hours
in NaCl	.053125	.10625	.2125	.425	.85	per cent.
in $CaSO_4$	.0028125	.005625	.01125	.0225	.045	per cent.
in $MgCl_2$	.0053125	.010625	.02125	.0425	.085	per cent.
there were	15	15	15	15	12	survivors.

Time of acclimatization 120 hours.
Average strength of preparatory solution in Na .199 per cent.
Average strength of preparatory solution in Ca .0105 per cent.
Average strength of preparatory solution in Mg .0199 per cent.

Conclusion.—The ability of amphibian eggs to develop in sea water is dependent on the principle of ionic antagonism. In addition to this, however, their power of acclimatiza- plays an important rôle, for it not only enables them to withstand the passage from dilute to strong solutions, but the opposite process as well. Thus larvæ which have just reached a point where they fail to react to tactile stimuli in solutions which do not bring about dehydration, either because the solutions are too weak, or because the larvæ have been acclimated, will if transferred to fresh or distilled water recover in from one to two hours. If in addition to this we remember that the species found by Pearse is probably racially acclimated to the conditions under which it lives, his findings do not appear inexplicable.

OTTO GLASER
ZOOLOGICAL LABORATORY,
UNIVERSITY OF MICHIGAN,
July 15, 1912

THE SCALES OF DERMOPHIS

IN SCIENCE, July 28, 1911, p. 127, I described the scales of the Asiatic amphibian *Ichthyophis,* pointing out their resemblance to certain fish scales. Early this year my wife and Mr. Earl Morris obtained a number of amphibians and reptiles at Quirigua, Guatemala,[1] and among them a specimen of the Cœciliid amphibian *Dermophis mexicanus* Peters. The scales of this animal are minute, oblong to suboval, superficially similar to those of *Ichthyophis.* The essential structure is also the same, but the cell-like areas, instead of being more or less brick-shaped, are long and narrow, usually pointed at the ends, as though compressed. The scales of *Ichthyophis* are finely granular, but *Dermophis* shows little of this. The structure of the *Dermophis* scale is even more like that of the eel *Synaphobranchus pinnatus* than is that of *Ichthyophis.*

On the whole, the correspondence in minute structure between the scales of the two Cœciliids examined, from opposite sides of the world, is very striking. It is evident that in the Cœciliids, as well as in the more primitive types of scaly fishes, scale-structure is extremely persistent. It is proper to say, however, that the two genera are otherwise rather close in structure, and it remains to be seen whether the scales of more divergent genera, such as *Cryptopsophis* or *Gymnophis,* present any marked differences.

T. D. A. COCKERELL
UNIVERSITY OF COLORADO

[1] These were very kindly determined for us by Dr. L. Stejneger. It may be worth while to give the list, as a contribution to the knowledge of their distribution: *Leptophis mexicanus* (Dum. & Bibr.), *Streptophorus atratus sebæ* (Dum. & Bibr.), *Ameiva undulata* Gray, *Bufo valliceps* Weigm., *Hyla baudinii* Dum. & Bibr., *Dermophis mexicanus* Peters, *Spelerpes* (? *rufescens* Cope, condition poor).

MINERAL CONTENT OF VOLANIC ASHES FROM KODIAK[1]

FOLLOWING the recent eruption from Mount Katmai (the first week of June, 1912) samples of the volcanic débris falling near the Agri-

[1] Published by permission of the Secretary of Agriculture.

cultural Experiment Station in Kodiak were collected.[2] The samples here described were submitted to this bureau through the Office of Experiment Stations and a mineralogical examination of them was made.

Sample No. I. is light in color and rather coarse. It represents the first fall, which reached a depth of about six inches. There are present indeterminable feldspars, a slight amount of muscovite and a few apatite inclusions. Glass constitutes the larger part of the mass. The refractive index of this glass is below 1.50, thus indicating that the silica content is above 72.65 per cent.

Sample No. II. represents the second fall which reached about three or four inches in depth. It is reddish in color. The minerals present are hornblende, indeterminable feldspars, and biotite. Glass with the refractive index below 1.50 predominates. Some of the glass particles, however, had an index above 1.50. Obviously the material in the second fall is more basic than that of the first fall.

Sample No. III. represents the last fall, is light in color and very finely divided. Indeterminable feldspars, muscovite, and a few indeterminable particles of what appear to be some ferro-magnesian mineral are present. Glass with index below 1.50 predominates. Apparently the material in the last fall is between the first and second as regards basicity, *i. e.*, chemical composition.

These three mineralogical analyses indicate that the ashes were derived from a magma agreeing fairly well in composition with a granite magma. The silica content of three granites taken more or less at random from Washington[3] are as follows: (1) 72.48 per cent., (2) 76.91 per cent., (3) 74.40 per cent. The refractive index of the glass in these falls at Kodiak shows a silica percentage greater than 72.65, which makes the glass of the samples correspond very nearly in silica content with granite. The silica content of three obsidians, also taken from Washington, are as follows: (1) 75.52 per cent., (2) 76.68 per cent., (3) 76.20 per cent. These also agree fairly well with the silica content of the glassy part of the ash.

The analyses also indicate that a partial differentiation had taken place in the magma. Sample No. II. contains both hornblende and biotite which are not present in sample No. I. Moreover the index of some of the glass particles in No. II. indicates a lower silica content than is the case of the glass of the first and third falls.

As compared with ordinary soil material these falls are distinguished mainly by the high content of glass. There is every reason to anticipate that these glasses, as well as the definite minerals, would dissolve, hydrolize, and behave as would ordinary soil minerals. In fact the glasses would probably react with the soil water more rapidly than crystalline components of the soil.

No substances deleterious to plant growth were revealed by the examination, and on the whole these falls will probably serve ultimately as an enrichment of the preexisting soil, although it by no means follows that the immediate effects will be satisfactory.

William H. Fry

Bureau of Soils,
U. S. Department of Agriculture

[2] For a general description of this eruption see "Volcanoes of Alaska," *The National Geographic Magazine*, Vol. XXIII., p. 824, 1912.

[3] U. S. Geol. Surv., Professional Paper 14, 1903.

SOCIETIES AND ACADEMIES

THE AMERICAN MATHEMATICAL SOCIETY

The one hundred and sixtieth regular meeting of the American Mathematical Society was held at Columbia University on Saturday, October 26, extending through the usual morning and afternoon sessions. Fifty-two members were in attendance. Among those present were Professors Emile Borel, of the University of Paris, and Vito Volterra, of the University of Rome.

Vice-president Taber occupied the chair. The council announced the election of the following persons to membership in the society: Dr. Henry Blumberg, Brooklyn, N. Y.; Mr. J. M. Colaw, Monterey, Va.; Dr. F. M. Morgan, Dartmouth College; Dr. Louis O'Shaughnessy, University of Pennsylvania; Dr. C. T. Sullivan, McGill University.

Luncheon was served at the university. In the

evening sixteen members gathered at the usual dinner.

The following papers were read at this meeting:

H. W. Reddick: "Systems of plane curves whose intrinsic equations are analogous to the intrinsic equation of an isothermal system."

L. L. Dines: "Note concerning a theorem on implicit functions."

L. L. Dines: "Singular points of space curves defined as the intersections of surfaces."

E. T. Bell: "On Liouville's theorems concerning certain numerical functions."

E. T. Bell: "The representation of a number as a sum of squares."

G. R. Clements: "Implicit functions defined by equations with vanishing Jacobian. Supplementary note."

Edward Kasner: "Note on contact transformations of space."

E. H. Taylor: "An extension of a theorem of Painlevé."

L. S. Dederick: "On the character of a transformation in the neighborhood of a point where its Jacobian vanishes."

Vito Volterra: "Some integral equations."

W. F. Osgood: "Proof of the existence of functions belonging to a given automorphic group."

G. D. Birkhoff: "Proof of Poincaré's geometric theorem."

E. V. Huntington: "A set of postulates for abstract geometry in terms of the simple relation of inclusion."

Dunham Jackson: "On the degree of convergence of related Fourier series."

A. A. Bennett: "Note on the solution of linear algebraic equations in positive numbers."

The San Francisco Section of the society held its regular fall meeting also on October 26 at the University of California. The regular meeting of the Southwestern Section will be held at the University of Kansas on November 30. The annual meeting of the society, including that of the Chicago Section, will be held at Cleveland, Ohio, December 31 to January 2.

F. N. COLE,
Secretary

THE BOTANICAL SOCIETY OF WASHINGTON

A SPECIAL meeting of the society was held September 18, 1912, in honor of Professor Hugo de Vries, of the Hortus Botanicus, Amsterdam, who addressed the Society on "The Future of Plant Breeding as related to Agricultural Production." At the close of the address brief appreciative remarks were made by Professor W. M. Hays, Dr. E. F. Smith, Professor W. J. Spillman and Mr. F. V. Coville.

The 82d regular meeting was held at the Cosmos Club, Thursday, October 17, 1912, at 8:00 P.M., Mr. C. S. Scofield, president *pro tem.*, presiding. Nineteen members were present. Mr. W. H. Lamb, of the Forest Service, was elected to membership. The following papers were read:

The Cotton of the Hopi Indians: F. L. LEWTON.

This paper will be published in full in Smithsonian Miscellaneous Collections, Vol. 60, No. 6.

A Botanical Trip to the Sevier Forest, Southern Utah: W. W. EGGLESTON.

Damping-off of Coniferous Seedlings: C. P. HARTLEY.

With the exception of the cedars, damping-off of seedlings is a serious hindrance to the raising of conifer seedlings. Surfacing beds with gravel tends to decrease the trouble. The disease is generally worst under moist conditions, but a well-drained nursery in dry climate in southwestern Kansas has suffered especially heavy loss from damping-off parasites. No positive control method has ever been developed for general use.

In western porous soils damping-off is simply a root-rot of very young seedlings, which may attack at any point from the ground surface to several inches below. Seedlings several weeks old may have the younger parts of their roots rotted and yet survive.

Pythium debaryanum appears to be the most dangerous parasite in western nurseries. *Rhizoctonia* sp., *Fusarium* sp., and probably *Trichoderma lignorum,* also cause damping-off. *Pythium* and *Rhizoctonia* have been successfully inoculated on autoclaved soil; but inoculations do not succeed uniformly on unsterilized soil, due probably to competition of bacteria and other fungi. *Rhizoctonia* loses parasitism in culture and different strains vary greatly in virulence.

All active *Pythium* in nursery soil can be killed very cheaply by means of fungicides. Heat, and fungicides which break down soon after application, such as mercuric chloride, or acids and copper salts followed by lime, are not effective in the west, because *Pythium* often reinfects such disinfected soil, running through it rapidly before seedlings raised on it develop resistance. This reinfection at least sometimes takes place through the air, and is difficult to prevent under nursery conditions. Excellent results have been obtained by treating beds before seeding with sulfuric acid

and formalin, and on alkaline soils with zinc chloride and copper sulfate. These fungicides seem to leave a slight residue in the soil which protects reinfection. This protection sometimes fails. Rather complicated watering methods are necessary in the west to prevent chemical injury to the germinating seed by fungicides which leave residues. Further work is required to place any of the treatments on a firm economic basis.

The twelfth annual business meeting was held on Wednesday, October 30, 1912. Officers were elected as follows:

President—W. W. Stockberger.
Vice-president—C. R. Ball.
Recording Secretary—H. L. Shantz.
Corresponding Secretary—C. L. Shear.
Treasurer—F. L. Lewton.

The executive committee reported an active membership of 108.

W. W. Stockberger,
Corresponding Secretary

THE AMERICAN PHILOSOPHICAL SOCIETY

At the meeting of the American Philosophical Society, held October 4, 1912, a paper entitled "Some Tick-transmitted Diseases" was read by Professor G. H. F. Nuttall, M.D., Ph.D., Sc.D., F.R.S., of Cambridge, England. After referring to recent investigations dealing with the etiology of Rocky Mountain fever he gave a summary of our present knowledge of piroplasmosis in cattle, dogs, horses and sheep, and of certain differences exhibited by the parasites (*Piroplasma, Nuttallia, Thisleria*, etc.) causing the diseases grouped under the name of piroplasmosis. Spirochætal infections in man and animals were considered as well as the life cycle of the parasites (*Spirochætes*) in the bodies of the ticks which convey them to the vertebrate host. The economic importance of tick-transmitted diseases was pointed out.

On Restorations of North and South American Tertiary Mammals: W. B. Scott.

The method of making restorations of the external appearance of extinct mammals was first discussed, and it was pointed out that the popular idea concerning the feasibility of restoring an extinct form from a few scattered bones was entirely erroneous. Only skeletons that are practically complete can be employed to advantage. Given such skeletons, it is not difficult to build up the muscles, and thus to determine with much accuracy the general form and proportions of the animal. The uncertain factors of hair and color-markings were then considered, and it was shown that a reasonable approximation to the truth may be reached even in these matters. Lantern slides of some forty unpublished restorations of mammals from the Tertiary of North and South America were exhibited.

The following is an abstract of an address on "Electrons," given before the society at Philadelphia on Friday, November 1, by Sir William Ramsay, K.C.B., F.R.S.:

The actual existence of electrons in motion has been conclusively demonstrated; the mass of an electron is not far from one 1830th of that of an atom of hydrogen; and as the mass of an atom of hydrogen is now known with fair accuracy, that of an electron is nearly 0.8×10^{-27} gram. Electrons in motion *are* negative electricity; they constitute a form of matter, which, at present, has more claim to the term "elementary" than have most of the "elements." Indeed, metals must be regarded as compound bodies, of which one component consists of one or more electrons; these electrons are, as a rule, not very firmly attached, as is evident from the generally easy oxidation of most metals. Non-metals are also composed partly of electrons, not so easily detached. The "combination of elements with each other" consists in the shifting of one or more electrons from the more metallic to the less metallic element; no doubt it will some day be possible to give "structural formulæ" to the elements, showing the relationship in position, or in directed motion, between the true elements, and their attached electrons.

The word "electricity" has a dual meaning; it may mean first an assembly of electrons, stationary or in motion; or second, waves in the ether, produced by the stopping or starting of electrons in motion. The motion of electrons constitutes one factor of electrical energy; wave-motion in the ether can be used as a means of generating electrical energy, by employing the waves in making electrons move.

Progress in man's command of natural forces has been made by learning how to direct and control the motion of masses—in other words, by acquiring a knowledge of mechanics; progress in the future will consist in acquiring the power to control and direct the motions of electrons. This has already been largely achieved by electric contrivances; it is, however, only by the use of concrete ideas regarding the "material" used, viz., electricity, that the progress of invention and discovery can be hastened.